AD-A077 481 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. CLIFF LAKE DAM (INVENTORY NUMBER N--ETC(U)
SEP 79 G KOCH DACW51-79-C-0001

UNCLASSIFIED NL

1 OF 2
AD
A077481

AD A077481

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
Phase I Inspection Report
Cliff Lake Dam
Delaware River Basin, Sullivan County, New York
Inventory No. 584

5. TYPE OF REPORT & PERIOD COVERED
Phase I Inspection Report
National Dam Safety Program

6. PERFORMING ORG. REPORT NUMBER

LEVEL II

7. AUTHOR(s)
George Koch, P.E.

8. CONTRACT OR GRANT NUMBER(s)
DACW-51-79-C-0001

9. PERFORMING ORGANIZATION NAME AND ADDRESS
New York State Department of Environmental Conservation/ 50 Wolf Road
Albany, New York 12233

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
New York State Department of Environmental Conservation/ 50 Wolf Road
Albany, New York 12233

12. REPORT DATE
18 Sep[redacted]79

13. NUMBER OF PAGES

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)
Department of the Army
26 Federal Plaza/ New York District, CofE
New York, New York 10007

15. SECURITY CLASS. (of this report)
UNCLASSIFIED

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)
Approved for public release; Distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)
National Dam Safety Program. Cliff Lake Dam (Inventory Number NY 584), Delaware River Basin, [redacted], Sullivan County, New York. Phase I Inspection Report.

DDC RECEIVED NOV 30 1979 E

18. SUPPLEMENTARY NOTES

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Dam Safety
National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Cliff Lake Dam
Sullivan County

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of documents and visual inspection of Cliff Lake Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam, however, has a number of problem areas which if left uncorrected could lead to the development of potentially hazardous conditions. ~~These areas are:~~ cont

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED 393 970

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DDC FILE COPY

1. The structural stability analysis indicates that the dam does not meet the minimum stability criteria found in the "Guidelines" developed by the Corps of Engineers.

2. The hydraulic capacity of the outlet channel may be inadequate to pass the ½ Probable Maximum Flood (PMF) and requires investigation.

3. The condition of the foundation drains at the toe of the non-overflow section is unknown and requires investigation.

4. Shear keys in the non-overflow section are cracked and require investigation to determine if remedial action is necessary.

5. Seepage at the toe of the west embankment near the west abutment is estimated to be 200 gpm. Additional seepage was observed at the base of the old masonry dam at the toe of the new dam, and near the west abutment toe. These areas require investigation and possible remedial action.

The aforementioned problem areas require investigation which should be initiated as soon as possible and completed within 1 year from notification. Remedial measures necessary to insure the safety of the dam should be completed within the following year.

CONT

The discharge capacity of the spillway is inadequate for all flows in excess of 80 percent of the PMF; spillway capacity = 10,300 cfs without flashboards.

~~The following~~ problem areas were observed which require remedial action, and this action should be completed within the next construction season.

1. Repair the cracked, spalled, and deteriorated concrete and associated construction and expansion joints of the spillway and non-overflow sections, reservoir drain, and concrete drain cover at the toe of the spillway.

2. Clean and monitor all foundation drains at the base of the spillway and non-overflow sections.

3. Remove trees, brush, and debris from the crest, slopes, abutments, toe, and spillway, outlet and downstream channels from the access bridge to the spillway.

4. Repair the masonry and wood plank box at toe of the west embankment (west abutment), install a weir and monitor the seepage collected therein.

5. Install weirs at the base of the old masonry dam where seepage is emanating.

DELAWARE RIVER BASIN

CLIFF LAKE DAM

SULLIVAN COUNTY, NEW YORK

INVENTORY NO. N.Y. 584

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

CONTRACT NO. DACW-51-79-C0001

NEW YORK DISTRICT CORPS OF ENGINEERS

JUNE , 1979

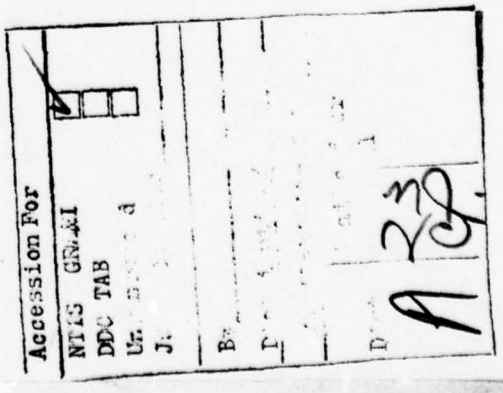
PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



DELAWARE RIVER BASIN
CLIFF LAKE DAM
NY 584
PHASE I INSPECTION REPORT

TABLE OF CONTENTS

APPENDIX

PHASE 1 REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Cliff Lake Dam (I.D. No. NY 584)
State Located:	New York
County Located:	Sullivan
Stream:	Black Lake Creek (tributary of Mongaup and Delaware Rivers)
Dates of Inspection:	November 8, 1978 and April 20, 1979

ASSESSMENT

The examination of documents and visual inspection of Cliff Lake Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam, however, has a number of problem areas which if left uncorrected could lead to the development of potentially hazardous conditions. These areas are:

1. The structural stability analysis indicates that the dam does not meet the minimum stability criteria found in the "Guidelines" developed by the Corps of Engineers.

2. The hydraulic capacity of the outlet channel may be inadequate to pass the ½ Probable Maximum Flood (PMF) and requires investigation.

3. The condition of the foundation drains at the toe of the non-overflow section is unknown and requires investigation.

4. Shear keys in the non-overflow section are cracked and require investigation to determine if remedial action is necessary.

5. Seepage at the toe of the west embankment near the west abutment is estimated to be 200 gpm. Additional seepage was observed at the base of the old masonry dam at the toe of the new dam, and near the west abutment toe. These areas require investigation and possible remedial action.

The aforementioned problem areas require investigation which should be initiated as soon as possible and completed within 1 year from notification. Remedial measures necessary to insure the safety of the dam should be completed within the following year.

The discharge capacity of the spillway is inadequate for all flows in excess of 80 percent of the PMF; spillway capacity = 10,300 cfs without flashboards.

The following problem areas were observed which require remedial action, and this action should be completed within the next construction season:

1. Repair the cracked, spalled, and deteriorated concrete and associated construction and expansion joints of the spillway and non-overflow sections, reservoir drain, and concrete drain cover at the toe of the spillway.

2. Clean and monitor all foundation drains at the base of the spillway and non-overflow sections.

3. Remove trees, brush, and debris from the crest, slopes, abutments, toe, and spillway, outlet and downstream channels from the access bridge to the spillway.

4. Repair the masonry and wood plank box at toe of the west embankment (west abutment), install a weir and monitor the seepage collected therein.

5. Install weirs at the base of the old masonry dam where seepage is emanating.

6. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information and develop an operations manual.

George Koch

George Koch
Chief, Dam Safety Section
New York State Department
of Environmental Conservation
NY License No. 45937

Approved By:

David A. Benn

Col. Clark H. Benn
New York District Engineer

Date: 18 September 1979

Overview of Cliff Lake Dam
Photo #1

Upstream Face
Photo #2 A&B

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
CLIFF LAKE DAM, I.D. NO. NY 584
DEC #148D-1133
DELAWARE RIVER BASIN
SULLIVAN COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase 1 Inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to life and property and recommend remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of the Dam and Appurtenant Structures

Cliff Lake Dam consists of a 100-foot long unreinforced concrete gravity spillway buttressed at both abutments, a 180-foot long unreinforced concrete gravity non-overflow section on the east side of the spillway, and 2 earth embankments, one on the west side of the spillway approximately 270 feet long, and one on the east side of the non-overflow section approximately 95 feet long. The maximum height of the dam is 50 feet.

(1) Spillway Section

The upstream face of the spillway is vertical and the downstream face is sloped at 10 vertical on 6.5 horizontal. The crest is rounded. The spillway is founded on bedrock and keyed into bedrock at the upstream edge of the base. The height of the spillway is approximately 40 feet. An 8" x 8" box drain located 8 feet from the upstream face of the spillway serves to collect seepage and reduce uplift forces beneath the spillway. A 4-foot square concrete box drain located near the west side of the spillway serves as a reservoir drain.

(2) Non-overflow Section

The upstream face of the non-overflow section is vertical, the crest is horizontal and 5 feet wide, the downstream face is vertical for the upper most 10 feet then slopes at a rate of 10 vertical to 6 horizontal down to the base. This section is founded on bedrock with foundation drains and bedrock key identical to that of the spillway section. The non-overflow section has a crest elevation 10 feet higher than the spillway.

(3) Embankment Sections

The upstream face of the west earth embankment section is riprapped (18" thick) and has a slope of 1 to 3. The crest is 20 feet wide and composed of 2 feet of gravel. The downstream face is also riprapped (8" thick) and has a slope of 1 to 2.5. The maximum height is 50 feet. The embankment is composed of a core of "Impervious Material", and "Compacted Glacial Till" sections adjacent to the core. The core is 12 feet wide at elevation 1078 (below the 2 feet of gravel for the crest) and slopes at a rate of 2 to 1 down to original grade. A cut-off trench of "Impervious Material" extends from original grade down to bedrock or impervious material and varies from 20 to 50 feet in width. An "Impervious Blanket", 3 feet thick, was placed on original grade (after stripping) and extends from the core to the upstream cofferdam used to dewater the area. The base of the embankment on the downstream side of the core was also stripped and "Selected Gravel and Sand" was placed from the core to the rock fill toe and behind the existing "Dry Laid Masonry Dam". The impervious material behind the old dam was to be removed, the rock fill toe placed, and the area behind the old dam brought up to the top of the old dam by placement of "Coarse Gravel and Stones". The embankment was keyed into the existing grade at the west abutment with "Impervious Material" in the core area. At the spillway abutment, a concrete key wall 5 feet long and 3 feet wide extends into the impervious core of the embankment.

The east embankment is identical to the west embankment with the following exceptions:

1. The upstream slope is 1 to 2.5;
2. No clay core was noted on the plans;
3. A concrete core wall extends a minimum of 30 feet into the west end of the embankment from the non-overflow section.

Flow from Cliff Lake is not generally permitted over the spillway. Rather, the flow is drawn-off via a 4 x 5 foot rock tunnel on the east side of the Lake to augment supply in the Swinging Bridge reservoir. Flow from Lebanon Lake augments the flow of Cliff Lake via a 4-foot diameter concrete pipe and an open channel.

b. Location

Cliff Lake is located on the Black Lake Creek, a tributary of the Mongaup River, approximately 2.5 miles south of the Village of White Lake, N.Y.

c. Size Classification

The dam is 50 feet high and is classified as an intermediate dam (between 40 and 100 feet high).

d. Hazard Classification

The dam is classified as "high" hazard due to the potential for a chain reaction failure situation of the dams within the Mongaup River Basin which are above the Village Mongaup.

e. Ownership

The dam is owned and operated by the Orange and Rockland Utility Company, 1 Bluehill Plaza, Pearl River, New York, Tel.: (914) 627-2410.

f. Purpose of the Dam

The dam provides storage for power development at the Swinging Bridge generation plant.

g. Design and Construction History

The dam was constructed in 1925 and reconstructed in 1938-9. The dam was designed by Charles H. Tenny and Co., 200 Devonshire Street, Boston, Massachusetts. The reconstruction was designed by Charles T. Main, Inc., 201 Devonshire Street, Boston, Massachusetts. No engineering information pertaining to construction history was available.

h. Normal Operating Procedures

Water stored in the reservoir is used to augment the storage capability of Swinging Bridge reservoir for the generation of electricity below the Swinging Bridge Dam. Water from Cliff Lake is transmitted to Swinging Bridge reservoir via a 4 x 5 foot rock tunnel located on the east side of the Lake.

1.3 PERTINENT DATA

a. Drainage Area (sq. mi)	29.5
Height of dam (feet)	50.0
b. Discharge at Dam Site (cfs)	
Maximum known Flood	N.A.
Spillway at Design Pool (El. 1076.8)	4,300
Spillway at Maximum Pool (El. 1080)	10,300
Maximum Capacity of Reservoir drains	400
Total Discharge, Max. Pool	10,700
Average Daily Discharge	Variable

c. Elevation (ft. above MSL-Datum)

Top of Dam	1,080.0
Design Pool	1,076.8
Spillway Crest	1,070.0
Pool Level with Flashboards - if any	1,071.2
Tailrace Channel	1,030.0
Invert Reservoir Drain Outlet	1,036.0

d. Reservoir

Length of maximum Pool, miles	2.25
Length of Shoreline (Spillway Crest) miles	6.20
Surface area (Spillway Crest) acres	190.0

e. Storage, (Acre-feet)

Spillway Crest	2,800
Maximum Design Pool	4,100
Top of Dam	5,000

f. Dam

Type: Concrete Ogee Spillway and Abutments, Earth Embankments

Length (ft.)	610
Upstream slope	3:1
Downstream slope	2.5:1

Impervious Core Materials: Fine Sand & Clay

Crest Elevation, ft.	1,080
Crest Width, ft.	20
Grout Curtain	None

g. Spillway

Type:	
Length, ft.	100
Crest Elevation MSL	1,070
Upstream Channel:	Natural Fill
Downstream Channel:	Concrete

h. Regulating Outlets

4' x 4' Sluice Gate, Operated Manually at the Spillway.
4' x 5' Rock Tunnel to Swinging Bridge Reservoir

i. Reservoir Drain

4' x 4' Drain at the Spillway

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Geology

The Cliff Lake Dam is located in the "Appalachian Uplands" physiographic province of New York State. This province (the northern extreme of the Appalachian Plateau) was formed by the dissection of the uplifted but flat lying sandstones and shales of the Middle and Upper Devonian Catskill Delta. Relief is high to moderate. Maximum dissection occures in the Catskill Mountain area, where only the mountain peaks approximate the original plateau surface. Drainage is generally south or southwest toward the Delaware River system.

b. Subsurface Investigation

Subsurface investigation was conducted about 1938, and this information has been included in Appendix G Drawing #1300-52. In general, the borings indicate that the soils at this site are of glacial till origin (sand, clay, and stone of varying mixtures) over gray sandstone and shale bedrock.

The "General Soil Map of New York State" prepared by Cornell University, Agriculture Experiment Station indicates that the surficial soils are of the Lackawanna series. This soil series has poor internal drainage characteristics. Boulders are common and the depth to bedrock is variable.

Sandstone bedrock was observed to outcrop in the channel below the spillway, the downstream channel, and at the abutment of the access bridge below the old dam.

2.2 CONSTRUCTION RECORDS

The only information regarding construction of the dam is the year of construction 1925 and the year of reconstruction 1938-9.

2.3 OPERATION RECORD

All information concerning operation and maintenance of the dam is on file at the Swinging Bridge power house.

2.4 EVALUATION OF DATA

Some of the data presented in this report has been made available by representatives of Orange and Rockland Utilities, Inc. This information has been invaluable in the preparation of this report. All information gathered appears to be adequate and reliable for Phase I Inspection purposes.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of Cliff Lake Dam and the surrounding watershed was conducted on November 8, 1978 and April 20, 1979. The weather was clear and the temperature ranged in the fifties. The reservoir level at the time of inspection was 1067.5 (USGS). Flashboards 1.2 feet in height were in place at the time of the inspections, although the lake level was below the crest elevation.

b. Spillway Section

Surface spalling of concrete was evident particularly at the construction joints. The wingwalls are cracked and deteriorated. Hairline cracks were noted in the spillway concrete. A 1-inch opening was observed at the contact of the spillway toe and the apron. No indication of recent movement and no seepage was observed. (See Photo #3) A 2-inch diameter pipe was protruding from the spillway; purpose unknown. Two rectangular drains were noted at the base of the spillway. (See Photo #4) These drains provide relief of seepage and uplift forces beneath the spillway and non-overflow sections (See sketch Appendix C, Section 6, and Appendix G, Drawings #1300-56 and 1300-57 for drain details). Seepage from these drains was clear and estimated to be 5 gpm from the west drain and 8 to 10 gpm from the east drain. Approximately 1 gpm was evident seeping from the east wingwall drain. These drains are partially blocked with debris and vegetation. The area behind this wingwall is soft and wet with vegetation present having an affinity for water (See Photo #3B).

Seepage from spillway area flows into a narrow outlet channel. This channel is formed from the natural bedrock, and the west spillway wingwall seepage was rusty, and deposits of rust were evident in the spillway and outlet channels. (See Photos #14 & 16)

Considerable tree growth and debris was observed in the outlet channel and spillway channel. An access bridge also constricts the spillway flow below the dam. (See Photo #15) The outlet channel is extremely narrow and overtopping of the channel walls may result during high flow conditions.

c. Non-overflow Section

Surface spalling, calcification, and deterioration was evident in the non-overflow section of the dam particularly at the construction joints, along the top of this section and at the east wingwall of the spillway (See Photos #5,6,&7). Surface spalling on the eastern most panel of the downstream face was 2 to 3 inches (Photo #7); on the upstream face spalling was approximately 6 inches at the western most construction joint. Numerous hairline cracks were evident, and 2 of the vertical shear keys at the construction joints had hairline cracks through the shear key, indicating reduced strength of the key. A large depression at the base of the non-overflow section was observed (See Photo #7). The size of the depression was 28 feet long, 5 feet wide, and 3 feet deep. The origin of the depression is unknown. No evidence of seepage or erosive

force was apparent, which would be needed to create this depression. This area may have been the remnants of construction excavation, or post construction excavation to clear the foundation drain outlets.

The plans indicate that 3 foundation drain outlets were installed at the toe of this section. Apparently, backfill at the toe obscured these outlets. Seepage encountered in the backfill of the east spillway abutment may result from these outlets.

d. Earth Embankment Sections

(1) West Embankment Section

The horizontal and vertical alignment of the west embankment section appears to be good. No evidence of surface cracks or movement of the slopes, crest, toe, or area beyond the toe was observed. (See Photos #1 & 10) Small trees were evident on the upstream and downstream slopes, and at both abutments. The upstream and downstream slopes are riprapped. A large depression was observed in the original grade beyond the west abutment, the origin of which is unknown. Trees growing in the depression indicate that this depression is not of recent origin. (See Photo #13) No erosion at the abutments was apparent.

No seepage was encountered on the slopes, at the toe, or beyond with the following exceptions: Seepage was observed at the west abutment downstream slope near the toe of the embankment. The seepage was collected by a deteriorating masonry and wood plank box, 7 feet long, 1.4 feet wide, and 3 feet deep. (See Photo #12) Deteriorated stoplogs were in place at the outlet end of the box to form a weir. At the time of the second inspection, 0.2 feet of flow was observed over the weir. Flow from this box was transmitted toward the old dam via an 8" steel pipe. Thereafter, the flow is dispersed through the porous backfill of the old dam and was observed exiting through the joints of the old masonry dam in an area approximately 25 feet wide. (See Photo #11) The flow was observed to be clear. Flow over the box weir is estimated to be 200 gpm. Weir measurements are recommended at the box and at the toe of the old dam to determine if the seepage at the old dam is completely from the box. The old dam is approximately 100 feet below the toe of the new dam, and the area behind the old dam has been filled to its top elevation. (See Photo #10). In addition, to the seepage at the west abutment, a soft wet area near the toe and approximately 15 feet east of the masonry and wood plank box was noted; no flow was apparent.

(2) East Embankment Section

The horizontal and vertical alignment of the east embankment section appears to be good. No evidence of surface cracks or movement of the slopes, crest, toe, or area beyond the toe was noted (See Photo #5). Small trees were evident on the upstream and downstream slopes, at the east abutment, and on the crest of the embankment. The upstream and downstream slopes are riprapped. No evidence of seepage was encountered on the slopes, at the toe or abutments, or beyond the toe of the east embankment section.

e. Downstream Channel

The downstream channel is partially bedrock formed. Numerous small trees, debris, and rock outcrops were observed. The side slopes appear to be stable with no unusual erosion problems observed. A narrow access bridge crosses the downstream channel approximately 50 feet below the old masonry dam. A sketch of this bridge is included in Appendix C. The bridge is used solely for maintenance and operation purposes by Orange and Rockland Utilities. (See Photos #14,15 & 16)

f. Reservoir

There are no visable signs of instability or sedimentation problems in the reservoir area.

g. Instrumentation

No instrumentation was in use at the dam, other than a staff reservoir gage located at the west abutment of the spillway.

h. Reservoir Drain

A 4-foot square concrete box drain located at the west edge of the spillway, with valve controls at the west spillway abutment serves as a reservoir drain.

The concrete at the drain is deteriorated at the outlet with reinforcing bars exposed. Slight seepage and calcification was evident in the walls of the drain initiating from the joint between the top and walls of the box drain. (See Photos #8 & 9) the concrete slab at the west end of the spillway channel which covers the reservoir drain is deteriorated and some reinforcing is exposed. Surface spalling was noted particularly at the construction joints.

The drain was reported to be operative.

3.2 EVALUATION OF OBSERVATIONS

No observations were noted which would indicate that the dam is in imminent danger. However, a number of problem areas may have the potential for the development of hazardous conditions if not monitored or left uncorrected. The significant problem areas and remedial action requirements are as follows:

a. Spillway Section

1. Significant deterioration of concrete particularly at the construction joints require repair.

2. The foundations drains should be cleaned of debris and vegetation, and monitored periodically to determine the influence of seepage and uplift.

3. Remove tree, vegetative growth and other debris in the spillway channel, at the abutments and along the tailrace channel.

4. Investigate the condition of the narrow outlet channel to determine if sufficient capacity exists within the channel to pass the ½ PMF, without overtopping of the channel or damage to the earth embankment portions of the dam.

b. Non-overflow Section

1. Significant deterioration of concrete of the non-overflow section should be repaired.

2. Investigate the condition of the shear keys to determine if the necessary strength is available to resist the shear forces.

3. Investigate the area at the toe of this section to determine the condition of the foundation drain outlets and the large depression. Drains should be kept free of debris and an outlet of sufficient capacity installed and maintained to assess the conditions of seepage and uplift beneath the dam.

4. Seepage observed exiting from behind the east spillway abutment should be investigated. This may be related to the adjacent foundation drain system.

c. Earth Embankment Sections

1. Repair the masonry and wood plank box at the toe of the west embankment near the west abutment. Install a new sharp crested weir and monitor the seepage therein.

2. Monitor the seepage by the use of weirs at the base of the old masonry dam and compare with the seepage from the box at the abutment. Monitor the seepage at the toe of the west embankment near the box at the abutment. Additional seepage investigations may be required after analysis of the weir flow information.

3. Remove the trees encountered on both embankment sections of the crest, slopes, abutments, and area beyond the toe of the dam.

d. Downstream Channel

Remove all trees and debris found within the downstream channel immediately above the access bridge to maintain a clear channel between the dam and the bridge.

e. Reservoir Drain

1. Repair the deteriorated concrete of the reservoir drain. Repair the construction joints within the drain.

2. Repair the deteriorated concrete slab which was poured above the reservoir drain.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURE

4.1 Procedure

Cliff Lake provides additional storage to augment the supply of Swinging Bridge reservoir from which power is generated. Lebanon Lake, which lies to the west of Cliff Lake also augments the flow. The flow from this lake is controlled with a 4-foot by 5-foot rock tunnel on the east side of the lake. Flow from Lebanon Lake is controlled by a 4-foot diameter concrete pipe. All valves and control systems are remotely operated by the system operators located on Dolson Avenue, Middletown, New York.

4.2 Maintenance of the Dam

The dam has not been maintained in proper condition. Deterioration of concrete and vegetative growth were observed.

4.3 Maintenance of Operating Facilities

The reservoir drain and valve, and the tunnel system connecting Cliff Lake to Swinging Bridge reservoir is reported to be operational. No operations manual is on file. A record of maintenance operations is on file with the maintenance staff.

4.4 Warning System In Effect

A recently updated warning system and emergency action plan for all Orange and Rockland Utility dams is on file with the appropriate personnel. This plan was developed in accordance with the Federal Energy Regulating Commission's standards and is included in Appendix G.

4.5 Evaluation

The structure is in need of considerable maintenance. A program of periodic inspection and maintenance should be initiated as soon as possible. This information should be documented for future reference.

SECTION 5: HYDROLOGIC/HYDRAULIC

5.1 Drainage Area Characteristics

The Cliff Lake Dam is located on the Black Lake Creek, a tributary of Mongaup River. The drainage area at the dam site is 29.7 square miles. The topography is characterized by steep slopes interspersed with swamps and lakes. Toronto Reservoir lies within the drainage area about 4 miles upstream of Cliff Lake Dam.

5.2 Analysis Criteria

Cliff Lake is augmented by Lebanon Lake (drainage area 7.8 square miles) through a 4-foot diameter concrete pipe and is drained by Swinging Bridge Reservoir (drainage area 118 square miles) via a 4' x 5' rock tunnel. The Cliff Lake drainage area is exclusive of Lebanon Lake and Swinging Bridge Reservoir drainage areas. Both the inflow from Lebanon Lake and outflow to Swinging Bridge Dam were excluded from the analysis.

Lake Superior, Black Lake, Toronto Lake, and Toronto Reservoir, which lie in the Cliff Lake drainage area upstream of the dam, were not analyzed individually in respect of their flood retarding capacities.

Information on the standard project flood (SPF) for the Cliff Lake Dam and its watershed was obtained from the "Upper Delaware River Basin Hydrologic Flood Routing Model" prepared in 1976 by Water Resources Engineers, Inc. for the New York District of the U.S. Army Corps of Engineers. The rainfall-runoff mathematical model HEC-1 developed by the U.S. Army Corps of Engineers was used to reconstitute major floods and to simulate the SPF considered in the study. The SPF is approximately one-half of the Probable Maximum Flood (PMF).

The Cliff Lake Dam Watershed consists of sub-basin 49 and northwestern part of sub-basin 51. The inflow was routed through the reservoir and the peak outflow was 6,400 cfs due to SPF.

5.3 Spillway Capacity

The ungated ogee spillway is 98 feet long, and the maximum head possible between the crest of the spillway and the top of the dam is 10 feet. However, the crest of the spillway is topped by 1.2-foot high flashboard reducing the maximum head to 8.8 feet. The computed capacities of the spillway at maximum head (top of dam) are 8,500 cfs with flashboards and 10,300 cfs without.

5.4 Reservoir Capacity

The reservoir's capacity is given below:

	EL. (feet)	Capacity (acre-feet)
Crest of spillway	1070.0	2,800
Top of flashboards	1071.2	3,000
Top of dam	1080.0	5,000

The storage capacity curve is shown in Appendix D. The curve indicates a surcharge storage of 2200 acre-feet above the crest of spillway and is equivalent to a runoff depth of 1.39 inches over the drainage area.

5.5 Flood of Record

No records of highest or lowest water levels on discharges were available from Orange and Rockland Utilities, Inc.

5.6 Overtopping Potential

The maximum capacity of the spillway is 10,300 cfs compared to a PMF of 12,800 cfs, and a ½ PMF of 6,400 cfs. Hence, the spillway can pass the ½ PMF and 80 percent of the PMF. There will be no overtopping of the dam due to ½ PMF. However, the dam will be overtopped by 10 inches due to PMF.

EVALUATION

The spillway is adequate to pass ½ PMF, but inadequate to pass PMF. The spillway can, however, pass 80 percent of PMF without overtopping. The capacity of the narrow outlet channel may be inadequate to pass the ½ PMF without damage to the toe of the earth embankment. An investigation is required to determine if additional outlet channel capacity is necessary.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The following observations are indicative of problems in connection with the stability of the earth embankment and concrete portions of the dam:

1. Concrete Portions

   (a) Significant deterioration of concrete surfaces, including cracking particularly at construction joints.

   (b) Cracking of the shear keys within the non-overflow section.

2. Earth Embankment Portions

   (a) Significant seepage (approximately 200 gpm) observed flowing through masonry and wood plank collection box near west abutment toe.

   (b) Soft wet area adjacent to west abutment toe.

   (c) Significant seepage flowing from base of old masonry dam which is at least in part due to west abutment seepage.

b. Design and Construction Data

No design computations or construction information concerning the structural stability of the dam was available. However, a structural stability analysis of the non-overflow and spillway sections of the dam was performed for the purposes of this report and is as follows:

Case 1 - Normal water surface (Elevation 1070), no tailwater, uplift.
Case 2 - Identical to "Case 1" with 5 kips/ft. ice load.
Case 3 - Probable Maximum Flood (Elevation 1080.9), no tailwater, uplift.
Case 4 - One-half Probable Maximum Flood (Elevation 1077.5), no tailwater, uplift.
Case 5 - Identical to "Case 3" with 5' tailwater.
Case 6 - Identical to "Case 4" with 3' tailwater.

Spillway Section (Middle 1/3 = 10.3 to 20.7)

Case	Factor Safety Overturning	Location of Resultant from toe	Factor of Safety Sliding
1	2.35	13.1	5.50
2	2.02	11.47	5.24
3	1.42	6.9	3.54
4	1.62	8.9	3.99
5	1.32	6.3	3.48
6	1.54	8.6	3.95

Non-overflow Section (Middle 1/3 = 6.3 - 12.7)

Case	Factor Safety Overturning	Location of Resultant from toe	Factor of Safety Sliding
1	2.33	8.6	14.0
2	1.77	6.5	11.7
3	1.20	2.7	6.58
4	1.46	5.0	8.09

These results indicate that the structure is stable for all loading conditions except cases 3 thru 6 for the spillway section, and cases 3 and 4 for the non-overflow section. No seismic analysis was conducted due to the small coefficient recommended for this seismic zone. It is recommended that further investigation be conducted to determine if remedial action is required to achieve the minimum recommended factors of safety. Information concerning the stability analyses performed is included in Appendix F.

c. Operating Records

No operational problems were reported which would influence the stability of the structure.

d. Post Construction Changes

No post construction changes were reported.

e. Seismic Stability

The dam is located in Seismic Zone 1. No seismic analysis is warranted.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 Assessment

a. Safety

The Phase 1 Inspection of Cliff Lake Dam did not indicate conditions which constitute an immediate hazard to human life or property. The dam, however, has a number of problem areas if uncontrolled may have the potential to develop into hazardous conditions.

b. Adequacy of Information

The information reviewed for the purposes of the Phase 1 Inspection Report is considered adequate.

c. Urgency

The following investigations should be initiated as soon as possible and completed within 1 year from notification:

1. Structural stability of the dam.
2. Capacity of outlet channel.
3. Adequacy of shear keys in non-overflow section.
4. Condition of foundation drains at base of concrete sections.
5. Repair, installation, monitoring and analysis of weirs at points of seepage within and below the west embankment section.

Remedial action concerning these investigations should be completed within 1 year from completion of the investigations.

d. Need for Additional Investigations

Investigation is required in the following areas: structural stability of the dam, capacity of the outlet channel to pass the ½ PMF without detrimental affects to the dam, adequacy of non-overflow section shear keys, condition of foundation drains, and seepage of the west embankment section.

7.2 Recommended Measures

a. Results of the required investigations will determine the type and extent of remedial measures necessary.

b. Repair cracked, spalled, and deteriorated concrete portions of the spillway section, non-overflow section, reservoir drain, and its cover slab. Repair all construction and expansion joints.

c. Clean and monitor all foundation drains at the base of the spillway and non-overflow sections.

d. Remove tree, vegetative growth and debris from the crest, slopes, abutments, toe, spillway channel, outlet channel, and downstream channel above the access road bridge.

e. Repair the masonry and wood plank box at the toe of the west embankment near the west abutment. Install a new sharp crested weir and monitor the seepage.

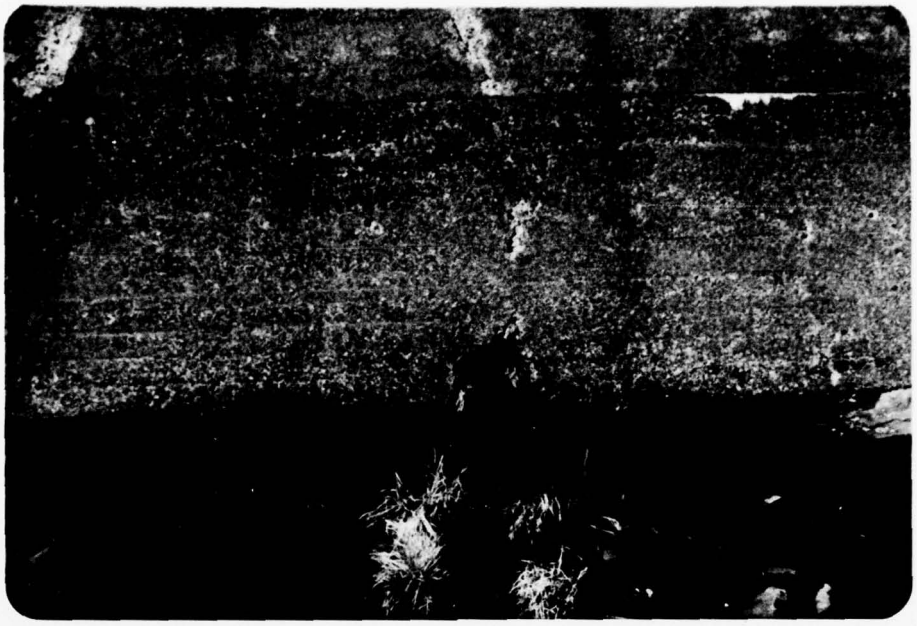
f. Install weirs and monitor the seepage which is exiting from the base of the old masonry dam.

g. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference. Also, develop an operations manual.

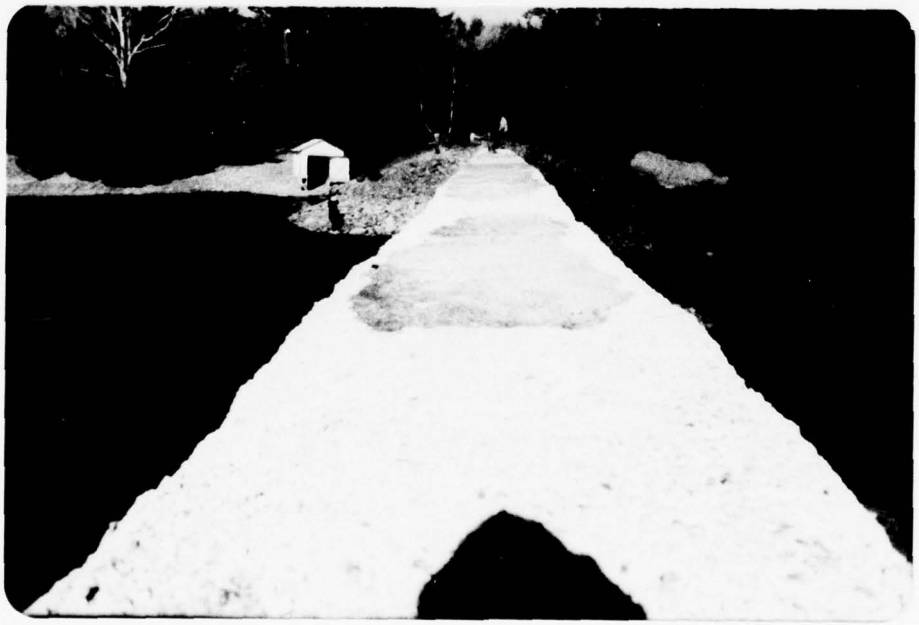
APPENDIX A

PHOTOGRAPHS

Spillway
Note Deteriorated Concrete
Photo #3 A&B



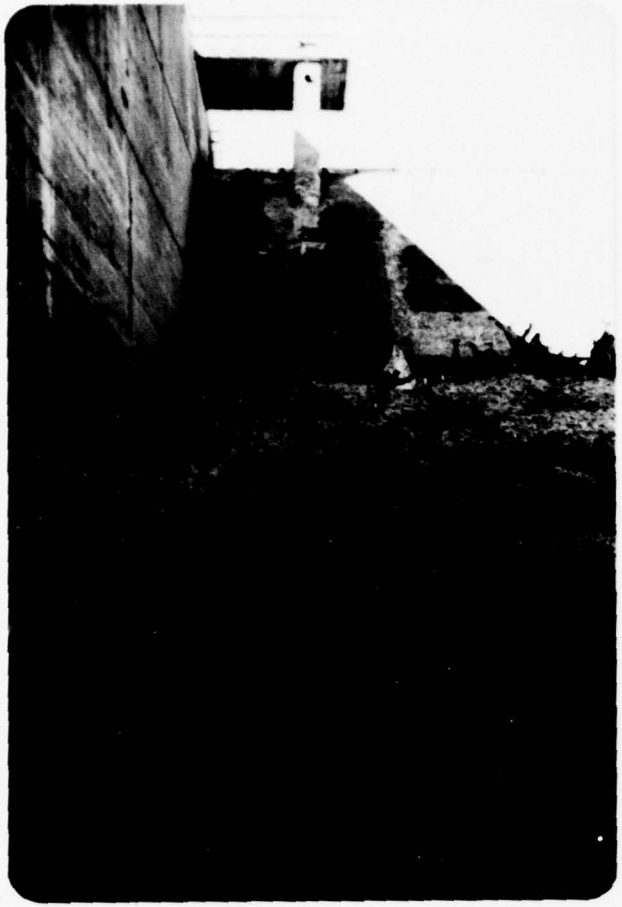
Spillway Foundation Drain
Photo #4



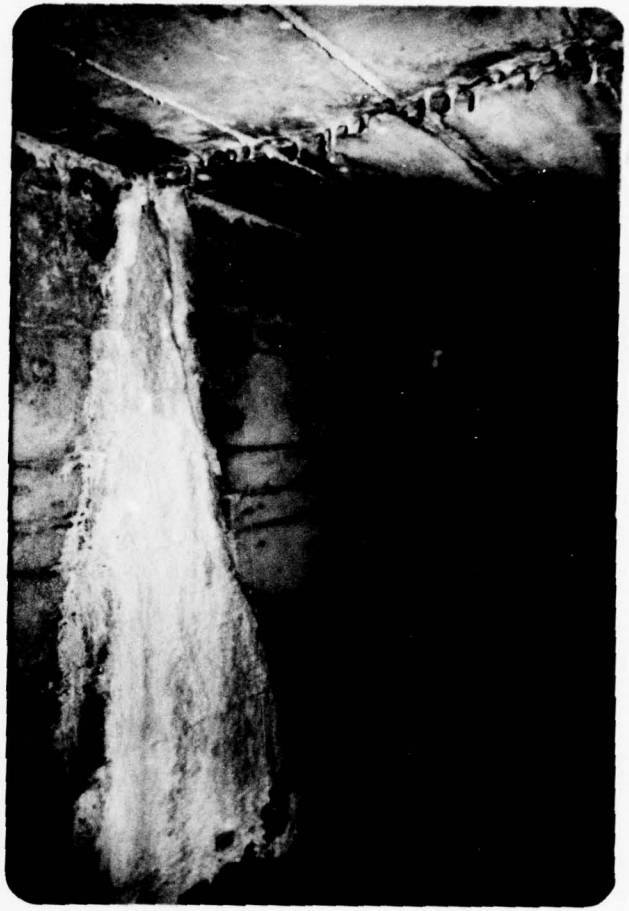
Crest of Non-overflow Section and East Embankment
Photo #5

Non-overflow Section
Downstream Face
Photo #6

Deteriorated Panel Non-overflow Section
Note Depression at Toe
Photo #7

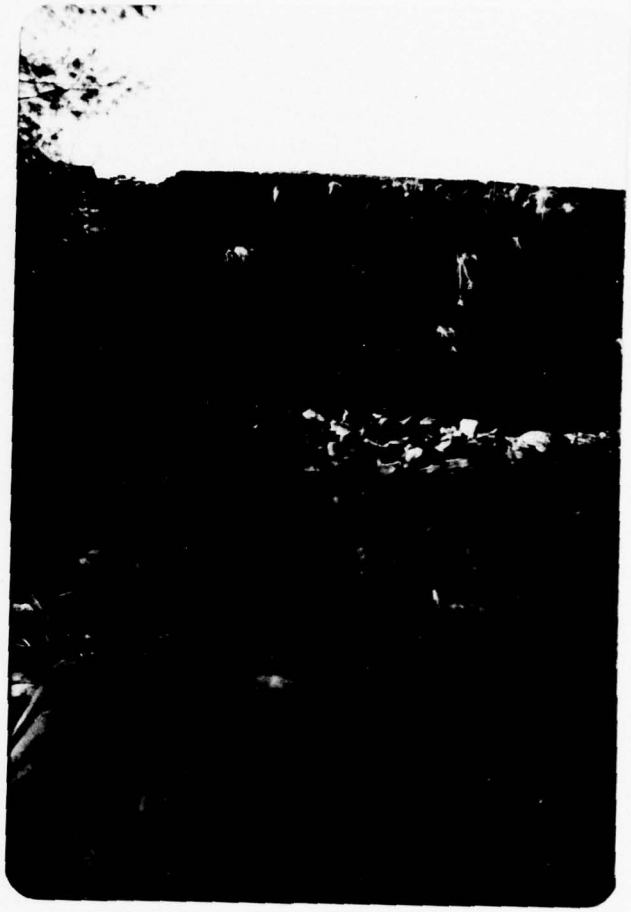


Reservoir Drain and Controls
Note Deteriorated Conrete and Exposed Reinforcing
Photo #8



Reservoir Drain Interior
Note Calcification at
Construction Joint
Photo #9

West Embankment and Spillway
Note Crest of Abandoned Masonry Dam
Phote #10



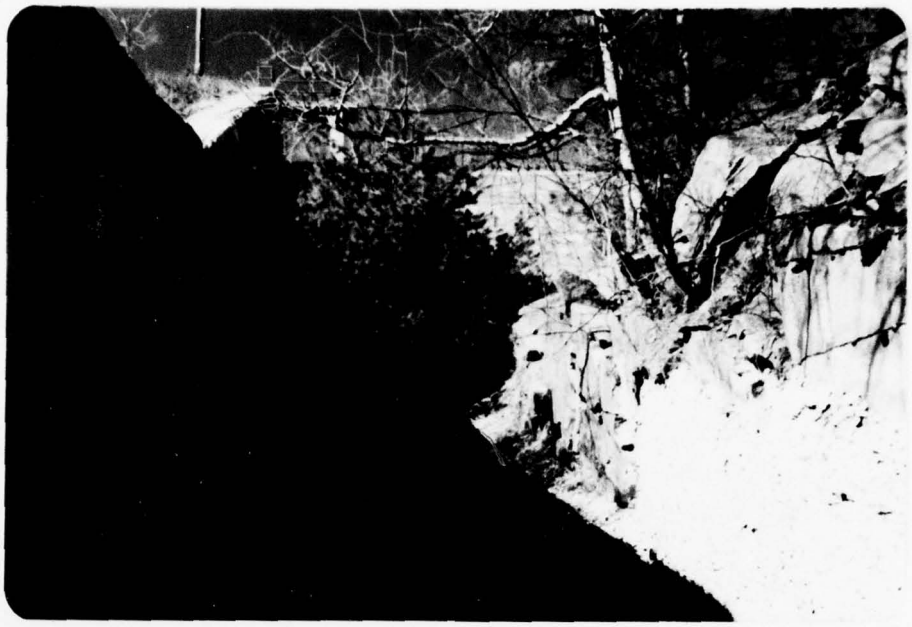
Abandoned Masonry Dam
Photo #11

Wood Plank Box
Collecting Seepage at West Toe of West Embankment
Photo #12

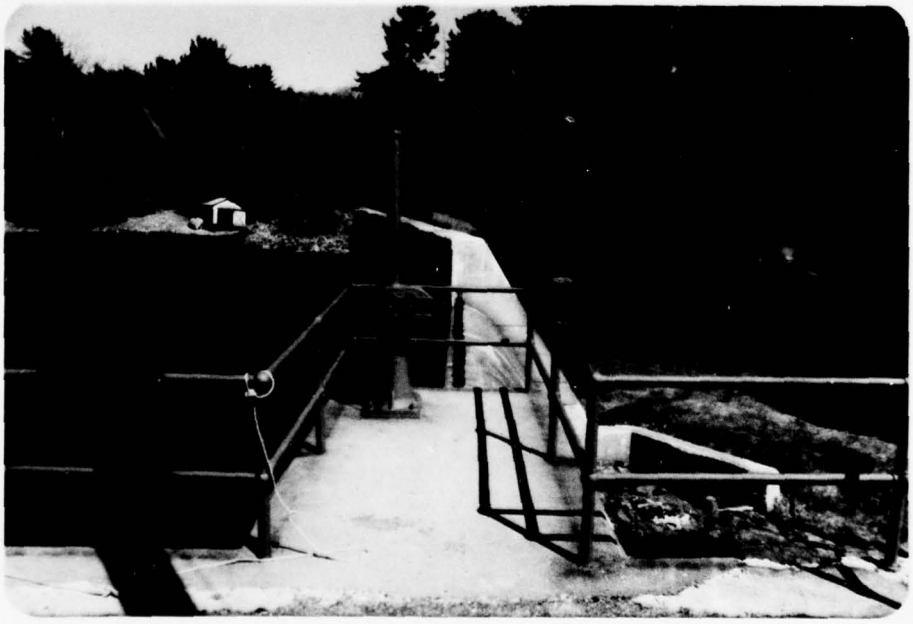
Depression in Original Grade
Near West Abutment of West Embankment
Photo #13

Outlet Channel Below Spillway
Photo #14

Downstream Bridge and Channel
Below Abandoned Masonry Dam
Photo #15



Outlet Channel
Note Narrow Channel Near Buttress
Photo #16



Reservoir Drain Controls,
Crest of Spillway and Non-Overflow Section
Photo #17

APPENDIX B

ENGINEERING DATA CHECKLIST

Check List
Engineering Data
Design Construction Operation

Name of Dam CLIFF LAKE

I.D. # NY. 534

Item	Remarks		
	Plans	Details	Typical Sections
Dam			
Spillway(s) RECONSTRUCTION	YES	YES	YES
Outlet(s)	NO	NO	NO
Design Reports	NONE		
Design Computations	NONE		
Discharge Rating Curves			
Dam Stability			
Seepage Studies	None		
Subsurface and Materials Investigations	None		

Item	Remarks
Construction History	NONE
Surveys, Modifications, Post-Construction Engineering Studies and Reports	NONE
Accidents or Failure of Dam Description, Reports	NONE
Operation and Maintenance Records Operation Manual	OPERATION RECORDS ONLY

APPENDIX C

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam CLIFF LAKE DAM

I.D. # NY 584

Location: Town LUMBERLAND County SULLIVAN

Stream Name BLACK LAKE CREEK

Tributary of MONGAUP RIVER

Longitude (W), Latitude (N) 74°-47'-40", 41°35'00"

Hazard Category C

Date(s) of Inspection NOV. 8, 1978, APRIL 20, 1979

Weather Conditions 50's. CLEAR, SUNNY.

b. Inspection Personnel ROBERT McCARTY, MUHAMMAD ISLAM

KEN FIELD

c. Persons Contacted KEN FIELD

ROBERT STUBER (914) 429-3061

d. History:

Date Constructed 1925, RECONSTRUCTED 1938-39

Owner ORANGE AND ROCKLAND UTILITIES INC.,

Designer CHARLES H. TENNY & CO. 200 DEVONSHIRE ST., BOSTON, MASS.
RECON: CHAS T. MAIN, INC., 201 DEVONSHIRE ST., BOSTON, MASS.

Constructed by

2) Technical Data

Type of Dam CONCRETE ABUTMENT, EARTH EMBANKMENT.

Drainage Area 29.5 SQUARE MILES

Height 50 Length 150 FEET (C. ABUTMENT.)

Upstream Slope 2.5:1 Downstream Slope 2.5:1 (EMBANKMENT)
3.0:1

2) Technical Data (Cont'd.)

External Drains: on Downstream Face NONE @ Downstream Toe NONE

Internal Components: EMBANKMENT

Impervious Core IMPERVIOUS MATERIAL

Drains NONE

Cutoff Type IMPERVIOUS MATERIAL

Grout Curtain NONE

TOP WIDTH 20 FEET

LENGTH 270 feet west embankment
95 feet east embankment

3) Embankment

Earth embankment on east and west side of spillway

a. Crest

(1) Vertical Alignment Good condition

(2) Horizontal Alignment Good condition

(3) Surface Cracks None observed

(4) Miscellaneous —

b. Slopes

(1) Undesirable Growth or Debris, Animal Burrows Small trees (pine) on upstream, downstream, west abutment (downstream), east abutment and on crest.

(2) Sloughing, Subsidence or Depressions Some minor unevenness in downstream riprap. No evidence of movement

(3) Slope Protection Riprap on upstream and downstream sides of both embankments.

(4) Surface Cracks or Movement at Toe None observed.

(5) Seepage Soft wet area in west abutment / west embankment near toe approximately 15 feet east of masonry/wood box (see next page).

(6) Condition Around Outlet Structure Deteriorated concrete.

c. Abutments

Large depression near west abutment on downstream face in original grade. Trees growing in the depression indicate that it has been this way for some time.

(1) Erosion at Embankment and Abutment Contact

None observed.

(2) Seepage along Contact of Embankment and Abutment and at toe on downstream face.

A masonry and wood plank box 7' long x 1.4' wide x 3' deep at the toe (downstream) of the dam near west abutment/west embankment. The box is equipped with stoplogs near the outlet end and water flows over this weir type log

(3) ~~Seepage at toe or along downstream face~~ (0.2' at the time of inspection) and into an 8" pipe (steel) which traverses along the west end of abutment and turns toward backfill of old dam. Thereafter, flow disappears into stone of old dam.

d. Downstream Area - below embankment (Flow is clear)

(1) Subsidence, Depressions, etc. None observed.

(2) Seepage, unusual growth The flow mentioned above then reappears at the downstream toe of the old dam in area 25' wide. The flow is clear. Weir measurements recommended at box and toe of old dam.

(3) Evidence of surface movement beyond embankment toe

None observed

(4) Miscellaneous Abandoned (old) dam approximately 100 ft. below toe of new) dam has been filled in.

e. Drainage System

masonry/wood box and 8" steel pipe drain as mentioned above.

(1) Condition of relief wells, drains, etc. _____

wood planks of the wood/concrete box is deteriorating.

(2) Discharge from Drainage System _____

4) Instrumentation

(1) Monumentation/Surveys NONE

(2) Observation Wells

(3) Weirs in wood/masonry box 7' long x 1.4' wide x 3' deep. Flow at the time of inspection 0.2' over weir in box.

(4) Piezometers NONE

(5) Other NONE

5) Reservoir

a. Slopes O.K.

b. Sedimentation NONE REPORTED

6) Spillway(s) (including tail race channel)

Concrete box reservoir drain (4'x4') is deteriorating. Slight seepage and calcification is evident at the joint of walls & floor and on floor. (See picture #)

~~a. General~~

Concrete cover at the base of spillway is deteriorated and some re-bars are exposed. Some surface spalling, especially at joints.

b. Principle Spillway Surface spalling of concrete especially on construction joints is evident. Wingwall cracked and deteriorated. There is a 1" opening at the contact of toe of spillway and apron. This does not seem recent and no seepage observed. Some bolts at toe probably for staging of forms. A 2" pipe on spillway (see sketch), dry, purpose unknown. There are 3 concrete-

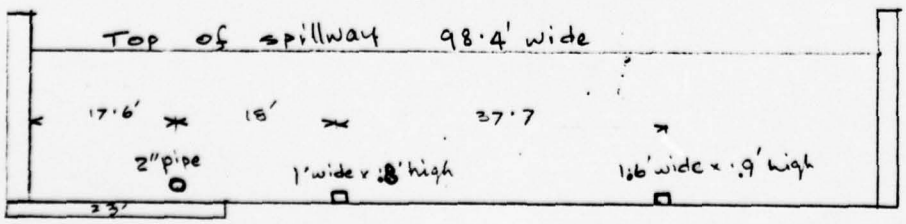
c. ~~Emergency or Auxiliary Spillway~~ rectangular drains — 2 at the base of spillway — 1 at the base of wing wall. Seepage water is clear — 5 GPM from west drain and 8-10 GPM from east drain, and 1 GPM of seepage from wing wall drain. The area on the other side of the wingwall is soft and wet. NO EMERGENCY SPILLWAY.

d. Condition of Tail race channel ~~Seepage~~ noted above flows in narrow spillway & tail race channel approx. ½" high and 4' wide - numerous trees in tailrace channel. Some deposits of rust observed in spillway & tailrace channels - flow from reservoir drain side of spillway 4" deep 6' wide

e. Stability of Channel side/slopes

Rock and concrete channel no problems tailrace very narrow (see photos).

← West — Looking upstream — East →



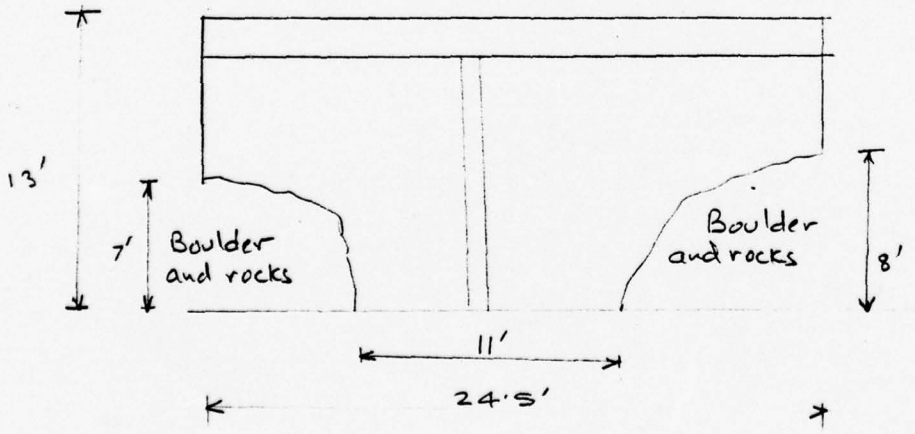
7) Downstream Channel

a. Condition (debris, etc.) Some debris, small trees and rock outcrop

b. Slopes No problems observed.

c. Approximate number of homes None below this dam. Water from this reservoir flows to Mongaup Falls reservoir. Potential chain reaction if the dam fails.

8) Miscellaneous



Access bridge on downstream channel
Looking downstream.

9) Structural

a. Concrete Surfaces Structural concrete non-overflow section east of spillway has considerable surface deterioration and calcification. This is particularly evident at the top and at the east wing wall. Surface spalling 2"-3" deep at the easternmost bottom

b. Structural Cracking panel (downstream) and at western most construction joint (upstream) was visible. There are 2 vertical hairline cracks on west wingwall, numerous cracks on spillway and on non-overflow section east of spillway.

c. Movement - Horizontal & Vertical Alignment (Settlement)

None apparent

d. Junctions with Abutments or Embankments

Appears good.

e. Drains - Foundation, Joint, Face 2 drains at the base of spillway and 1 drain at the back of wingwall (east). Some spalling of concrete around drain is apparent.

f. Water passages, conduits, sluices 4'x4' slide gate reservoir drain. Some seepage and calcification was noticed along walls & floor. 4'x5' rock tunnel to supply swinging bridge.

g. Seepage or Leakage No seepage through spillway or non-overflow section (concrete). Seepage through drains as explained in 6b.

h. Joints - Construction, etc. Cracks, deterioration and spalling is evident on construction joints of spillway and non-overflow section.

i. Foundation Large depression at the base of concrete non-overflow section. size of depression: 28' long x 5' wide x 3' deep.

j. Abutments Appear good

k. Control Gates 4'x4' slide gate reservoir drain and 4'x5' rock tunnel as explained in 9f.

l. Approach & Outlet Channels Approach channel is under water and not visible. Outlet channel is in rock. Some debris, trees and rock outcrop are visible.

m. Energy Dissipators (plunge pool, etc.) None

n. Intake Structures Under water. Not visible.

o. Stability

p. Miscellaneous Elevation of Lebanon Lake 1137. 4' dia concrete pipe from Lebanon Lake feeds cliff Lake.

APPENDIX D

HYDROLOGIC/HYDRAULIC

ENGINEERING DATA AND COMPUTATIONS

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	1080.0	240	5000
2) Design High Water (Max. Design Pool)	1076.8	-	4100
3) Auxiliary Spillway Crest	-	-	-
4) Pool Level with Flashboards	1071.2	200	3,000
5) Service Spillway Crest	1070.0	190	2800

DISCHARGES

	Volume (cfs)
1) Average Daily	Unknown
2) Spillway @ Maximum High Water	10,300
3) Spillway @ Design High Water	-
4) Spillway @ Auxiliary Spillway Crest Elevation	-
5) Low Level Outlet	400
6) Total (of all facilities) @ Maximum High Water	10,700
7) Maximum Known Flood	Unknown

CREST: ELEVATION: 1080.0

Type: CONCRETE ABUTMENT

Width: 5 FEET Length: FEET.

Spillover CONCRETE OGEE

Location 150 FEET WEST OF EAST EMBANKMENT.

SPILLWAY:

PRINCIPAL		EMERGENCY
1070.0	Elevation	NONE
OGEE	Type	
-	Width	
	Type of Control	
UNCONTROLLED	Uncontrolled	
	Controlled:	
FLASHBOARDS	Type (Flashboards; gate)	
	Number	
	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
NONE	Chute Length	
23 FEET	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate _____ Sluice _____ Conduit ✓ Penstock _____

Shape : 4'x4' Concrete box drain

Size: 4'x4'

Elevations: Entrance Invert 1047.0 ·

Exit Invert –

Tailrace Channel: Elevation –

HYDROMETEROLOGICAL GAGES:

Type : NONE

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: NONE

_____

Method of Controlled Releases (mechanisms):

Water is released to swinging Bridge Reservoir through a 4'x5' rock tunnel.

DRAINAGE AREA: 29.5 SQUARE MILES

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: _____

Terrain - Relief: _____

Surface - Soil: _____

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

NONE

Potential Sedimentation problem areas (natural or man-made; present or future)

NONE

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

NONE

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: NONE

Elevation: _____

Reservoir:

Length @ Maximum Pool 2.25 (Miles)

Length of Shoreline (@ Spillway Crest) 6.2 (Miles)

CLIFF LAKE DAM

Drainage area = 29.7 square miles.

From "Upper Delaware River Basin Hydrologic Flood Routing model" study, subbasin 49; pages T8 to F7:

Area of subbasin 49 = 23.2 square miles.

Drainage area of Cliff Lake contains subbasin 49 entirely and part of subbasin 51.

Modified Standard Project Flood $\approx \frac{1}{2}$ PMF

MSPF = 5,324 cfs (Subbasin 49)

PMF = 2 × 5324 = 10,648 cfs

$$\left(\frac{A_1}{A_2}\right)^{3/4} = \frac{PMF_1}{PMF_2}$$

$$\left(\frac{23.2}{29.7}\right)^{3/4} = \frac{10648}{PMF_2}$$

$\therefore PMF_2 = 12815 \approx 12{,}800$ cfs

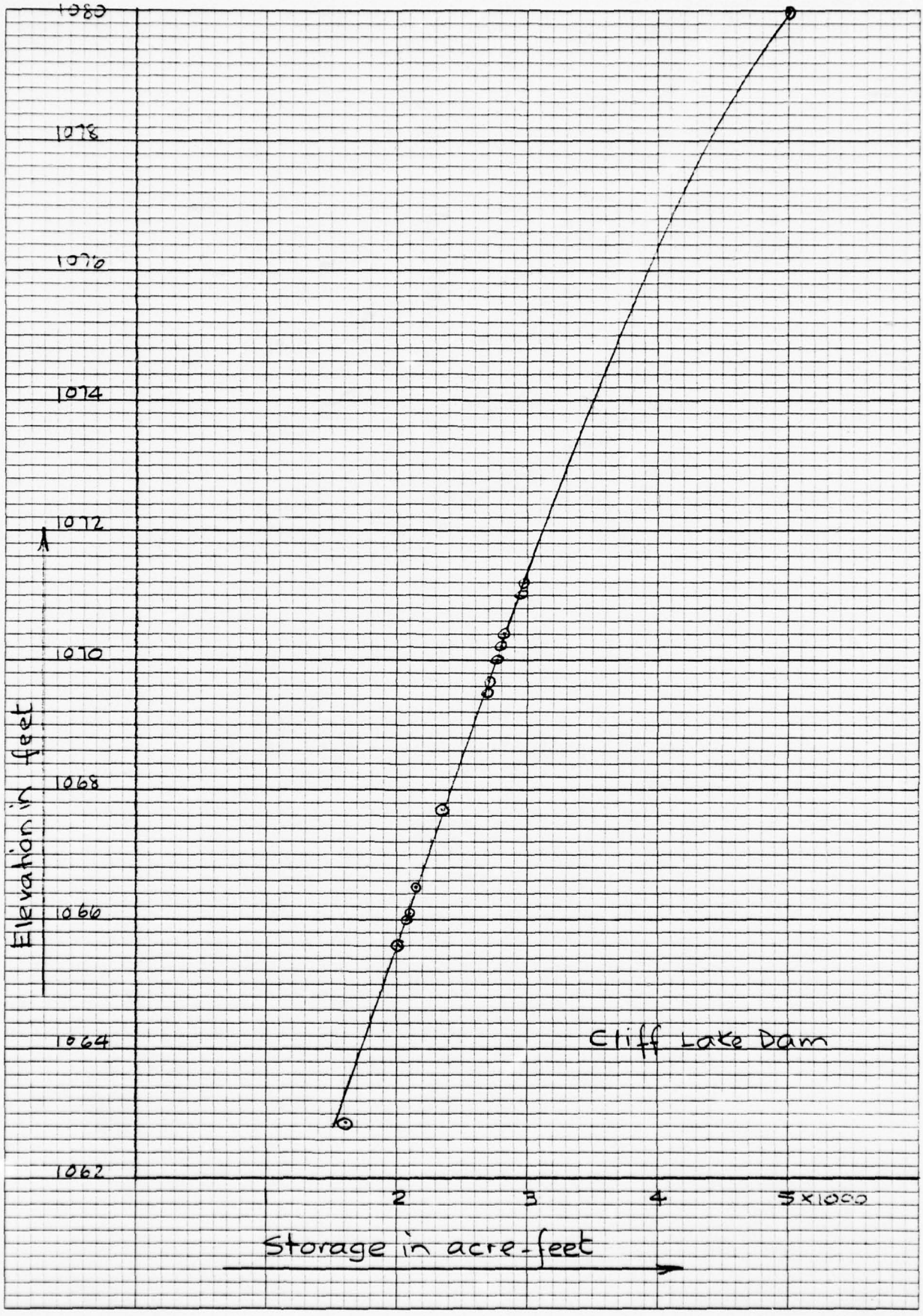
$\frac{1}{2}$ PMF = 6,400 cfs.

CLIFF LAKE

STORAGE CAPACITY CURVE

Elevation (feet)	Storage (acre-feet)
1062.9	1622
1065.6	2015
1066.0	2077
1066.1	2093
1066.5	2155
1067.7	2346
1069.5	2668
1069.7	2691
1070.0	2760
1070.2	2783
1070.4	2829
1071.0	2944
1071.2	2967
1080.0	5000

Capacity figures are based on zero storage at minimum operating pool level el. 1043.3 .



46 0700

K&E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO MADE IN U.S.A.

SPILLWAY RATING CURVE

CLIFF LAKE DAM

$C = 3.27 + 0.40 \frac{H}{h}$ For Ogee Spillway

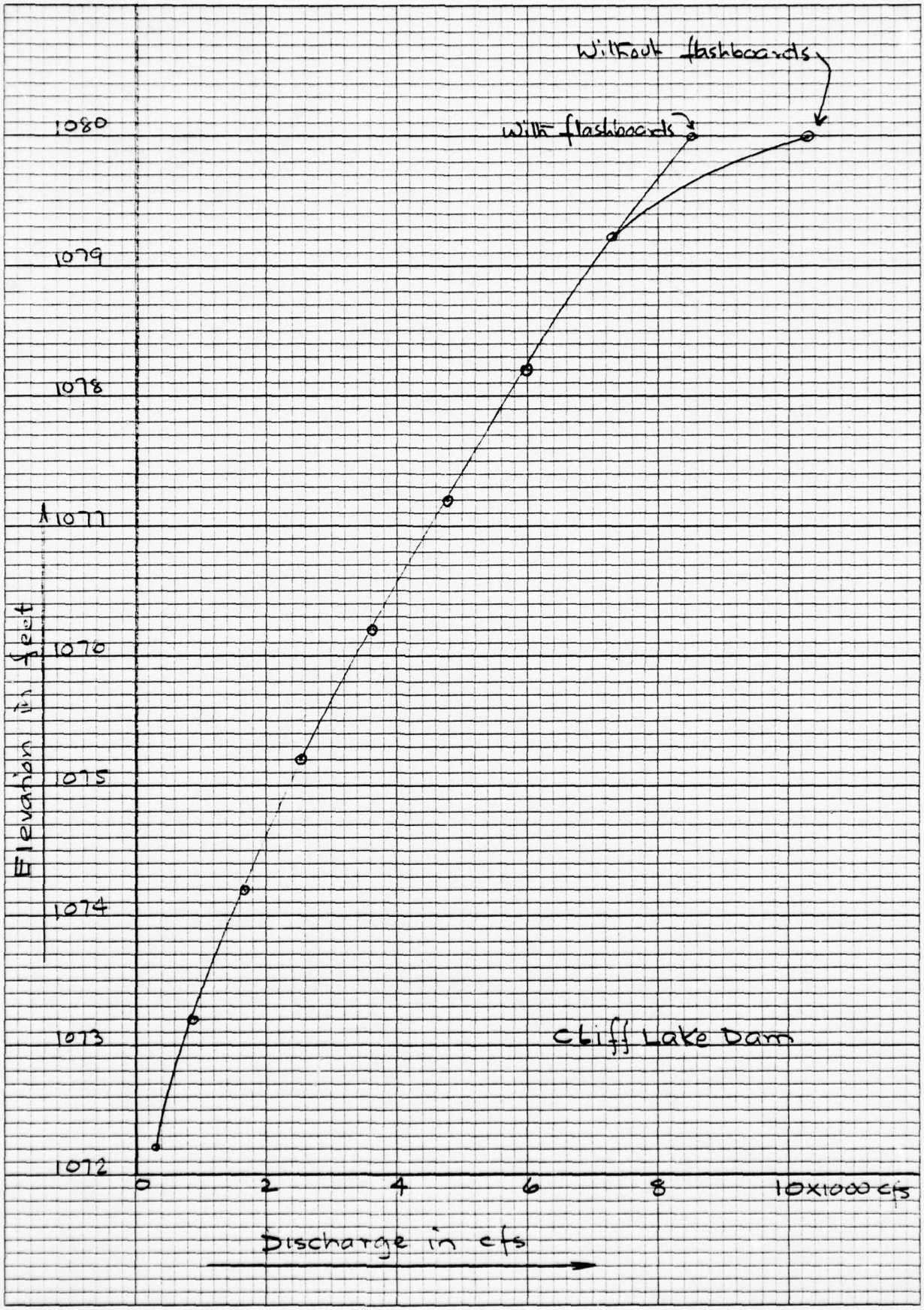
$L = L' - 0.1NH$

$Q = CLH^{3/2}$

$L' = 98.4$ Ft., $N = 2$

where C = Coefficient of Discharge
H = Head Over Spillway
h = Height of spillway
L = Crest length of spillway
L' = Measured Length of spillway
N = Number of End Contractions

EL. FT.	H, FT.	h, FT.	C	L, FT	Q, CFS	REMARKS
1072.2	1	41.2 with 1.2' Flash boards	3.28	98.2	322	With 1.2 feet high flashboards
1073.2	2		3.29	98.0	912	
1074.2	3		3.30	97.8	1677	
1075.2	4		3.31	97.6	2584	
1076.2	5		3.32	97.4	3615	
1077.2	6		3.33	97.2	4757	
1078.2	7		3.34	97.0	6000	
1079.2	8		3.35	96.8	7338	
1080.0	8.8	41.2	3.36	96.6	8473	
1080.0	10.0	40.0	3.37	96.4	10,273	without flashboard



Maximum capacity of reservoir drain

$$Q = C_c C_v A \sqrt{2gh}$$

$$= .66 \times .95 \times 4 \times 4 \sqrt{2 \times 32.2 \times 21}$$

$$= 368$$

Q = discharge in cfs
C_c = Coeff. of contraction
C_v = Coeff. of velocity
A = area in ft^2
g = Acceleration due to gr gravity in ft/sec^2
h = head in ft

Overtopping

PMF

$Q = CLH^{3/2}$ where C = Coeff. of discharge, L = Length

Length of spillway

$$12,800 = 3.37 \times 98.0 \times H^{3/2} + 3.28 \times 506 \times (H-10)^{3/2}$$

Length of embankment

H = 10 inches.

LIST OF REFERENCES

APPENDIX E

APPENDIX E

REFERENCES

1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May 1961.

2) Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, August 1972 (U.S. Department of Agriculture).

3) H.W. King and E.F. Brater, Handbook of Hydraulics, 5th edition, McGraw-Hill, 1963.

4) T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1965.

5) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.

6) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.

7) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes, Information Bulletin 119, 1977.

APPENDIX F

STABILITY ANALYSES

CLIFF LAKE DAM
STABILITY ANALYSIS

A stability analysis was performed on the subject dam with the use of a Texas Instruments Model #TI-59 Programmable calculator. A listing of the program may be obtained upon request.

Spillway Section

The following cases apply for the spillway section:

Case	Description of Loading
1	Normal loads, full uplift, no tailwater, reservoir at 1070.
2	Ice loading (5 K/ft.), full uplift, no tailwater, ice at 1069 ft.
3	Probable Maximum Flood (PMF), reservoir at 1080.9, 10.9 ft. over crest, full uplift, no tailwater.
4	½ PMF, reservoir at 1077.5, 7.5 ft. over crest, full uplift, no tailwater.
5	PMF, same as Case #3 with 5 feet of tailwater.
6	½ PMF, same as Case #4 with 3 feet of tailwater.

Non-overflow Section

The following cases apply for the non-overflow section:

Case	Description of Loading
1	Normal loads, full uplift, no tailwater, reservoir at 1070.
2	Ice load (5 K/ft.), full uplift, no tailwater, ice at 1069.
3	PMF, reservoir at 1080.9, 0.9 feet over top of dam, full uplift, no tailwater.
4	½ PMF, reservoir at 1077.5, 2.5 feet below top of dam, full uplift, no tailwater.

NOTE: A shear key located at the heel of the dam contributes to the sliding resistance of the dam. The stability analysis does not include this option. Therefore, the additional calculations below the computed factors of safety are shown to account for the benefit of the shear key.

INPUT FOR STABILITY ANALYSIS PROGRAM
SPILLWAY SECTION

	Input Parameter	Value					
		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
0	Unit Weight of Dam ($K/ft.^3$)	0.15	0.15	0.15	0.15	0.15	0.15
1	Area of Segment #1 ($ft.^2$)	718.6	718.6	718.6	718.6	716.8	716.8
2	Location of Center of Gravity from toe (ft.) Segment #1	20.67	20.67	20.67	20.67	20.67	20.67
3	Area of Segment #2 ($ft.^2$)	0	0	0	0	0	0
4	Location of CG from toe, Seg. #2 (ft.)	0	0	0	0	0	0
5	Area of Segment #3 ($ft.^2$)	0	0	0	0	0	0
6	Location of CG from toe, Seg. #3 (ft.)	0	0	0	0	0	0
7	Total Base Width of Dam (ft.)	31.0	31.0	31.0	31.0	31.0	31.0
8	Height of Dam (ft.)	40.0	40.0	40.0	40.0	40.0	40.0
9	Ice Loading (K/L.F.)	0	5.0	0	0	0	0
10	Coefficient of Sliding	0.6	0.6	0.6	0.6	0.6	0.6
11	Unit Weight of Soil ($K/ft.^3$)	0	0	0	0	0	0
12	Coefficient of Active Soil Pressure - Ka	0	0	0	0	0	0
13	Coefficient of Passive Soil Pressure - Kp	0	0	0	0	0	0
14	Height of Water over Top of Dam (ft.)	0	0	10.9	7.5	10.9	7.5
15	Height of Soil for Active Pressure (ft.)	0	0	0	0	0	0
16	Height of Soil for Passive Pressure (ft.)	0	0	0	0	0	0
17	Height of Water in Tailrace Channel (ft.)	0	0	5.0	3.0	5.0	3.0

INPUT FOR STABILITY ANALYSIS PROGRAM
SPILLWAY SECTION

Input Parameter		Value					
		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
18	Unit Weight of Water ($K/ft.^3$)	0.0624	0.0624	0.0624	0.0624	0.0624	0.0624
19	Area of Segment #4 ($ft.^2$)	0	0	0	0	0	0
20	Location of CG from toe, Seg. #4 (ft.)	0	0	0	0	0	0
46	Height of Ice Load or Active Water	40	39	40	40	40	40
49	Location of Foundation Drains from Heel (ft.)	8.0	8.0	8.0	8.0	8.0	8.0

NOTE: On the suceeding pages the following notation will be used:

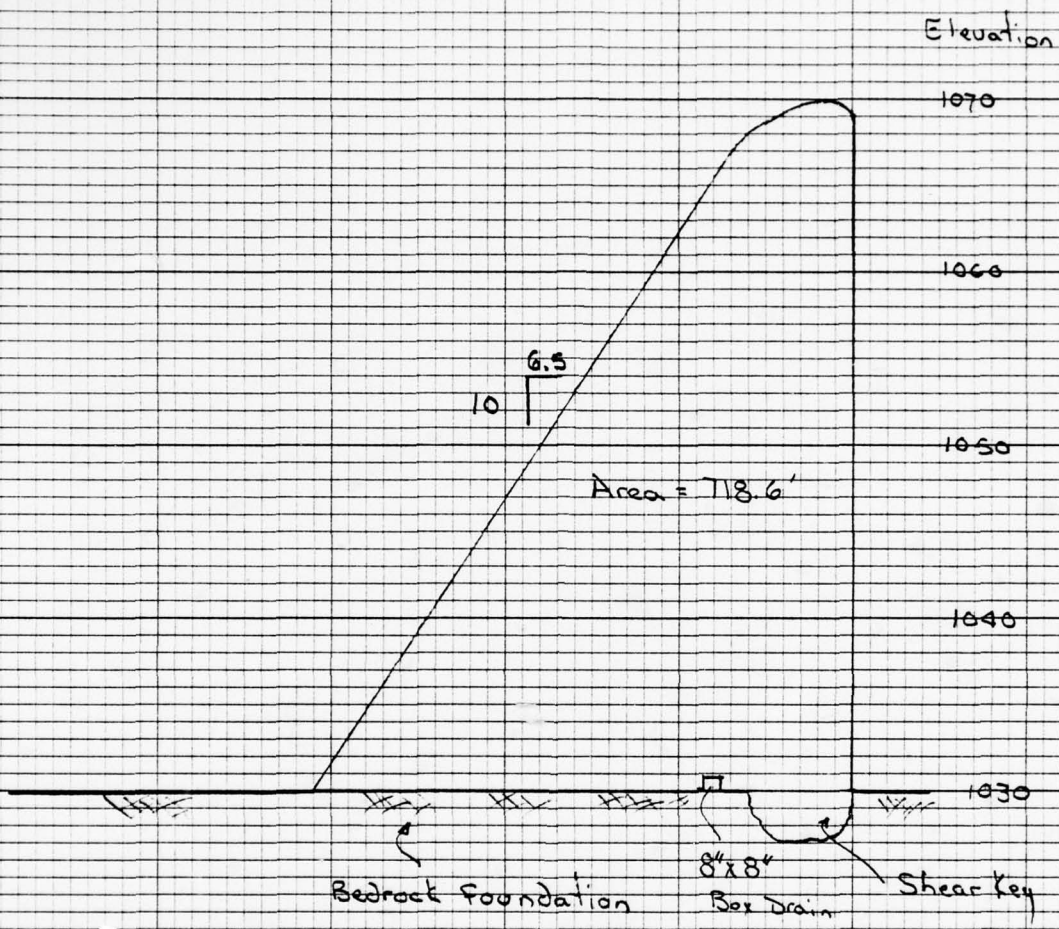
(a) is the factor of safety for overturning;

(b) is the location of the resultant from the toe;

(c) is the factor of safety for sliding without the benefit of resistance from the shear key;

(d) is the factor of safety for sliding with the benefit of resistance from the shear key.

Cliff Lake Dam
Spillway Section



Scale: 1" = 10'

middle 1/3 of base ranges
from 10.3' to 20.7'

Cliff Lake Dam
Stability Analysis
Spillway Section

Case 1 Normal Loading

Cliff Lake Normal Spillway Loads

(a) 2.349041941
(b) 13.08242132
(c) 1.175552885

5.	×	Width of shear key (ft)
1.	×	Depth of Section (ft)
144.	×	Inches^2 per foot^2
300.	÷	Shear Strength of Concrete #per inches^2
1000.	=	Pounds per Kip
216.		Shear Resistance of Key (Kips)
216.	+	
216.	RCL	
	45	
58.6836		Sum of Resisting Forces
58.6836	=	for Sliding (Kips)
274.6836		
274.6836	÷	
274.6836	(	
274.6836	RCL	
	29	
49.92		Driving force of Water
49.92	+	(Kips) triangular distribution
49.92	RCL	
	31	
0.		Driving force of water (Kips)
0.	+	Rect. dist. for water height above dam.
49.92	RCL	
	9	
0.		Driving force of Ice (Kips)
0.	+	Driving force of Active Soil
49.92	RCL	(Kips) on upstream side of dam.
	36	Sum of Driving Forces for Sliding (Kips).
0.		
0.	)	
49.92		
49.92	=	

(d) 5.502475962

F.S. sliding for shear key

Case 2 Ice Loading

Ice @ 39'

(a) 2.018967345
(b) 11.46773157
(c) 1.121592521

216.	+	
216.	RCL	
	45	
58.83336		
58.83336	=	
274.83336		
274.83336	÷	
274.83336	(	
274.83336	RCL	
	29	
47.4552		
47.4552	+	
47.4552	RCL	
	31	
0.		
0.	+	
47.4552	RCL	
	9	
5.		
5.	+	
52.4552	RCL	
	36	
0.		
0.	)	
52.4552		
52.4552	=	

(d) 5.239392091

F.S. sliding

Cliff Lake Dam
Stability Analysis
Spillway Section

CASE 3 PMF w/o Tailwater

Cliff Lake - spillway PMF w/o tailwater

(a)	1.419398305	
(b)	6.923531656	
(c)	.7~~2071066949~~	
	216.	+
	216.	RCL 45
	57.051216	
	57.051216	=
	273.051216	
	273.051216	÷
	273.051216	(
	273.051216	RCL 29
	49.92	
	49.92	+
	49.92	RCL 31
	27.2064	
	27.2064	+
	77.1264	RCL 9
	0.	
	0.	+
	77.1264	RCL 36
	0.	
	0.	)
	77.1264	
	77.1264	=
(d)	3.540308066	

F.S. sliding

CASE 4 ½ PFM w/o Tailwater

½ PMF w/o tailwater

(a)	1.619294218	
(b)	8.882140847	
(c)	.8~~8538391~~61	
	216.	+
	216.	RCL 45
	57.5604	
	57.5604	=
	273.5604	
	273.5604	÷
	273.5604	(
	273.5604	RCL 29
	49.92	
	49.92	+
	49.92	RCL 31
	18.72	
	18.72	+
	68.64	RCL 9
	0.	
	0.	+
	68.64	RCL 36
	0.	
	0.	)
	68.64	
	68.64	=
(d)	3.985437063	

F.S. sliding

Cliff Lake Dam
Stability Analysis
Spillway Section

CASE 5 PMF w/5' Tailwater

(a) 1.323628255
(b) 6.289660121
(c) ~~0.684299893~~

216.	+
216.	RCL
	45
52.776816	
52.776816	=
268.776816	
268.776816	÷
268.776816	(
268.776816	RCL
	29
49.92	
49.92	+
49.92	RCL
	31
27.2064	
27.2064	+
77.1264	RCL
	9
0.	
0.	+
77.1264	RCL
	36
0.	
0.	)
77.1264	
77.1264	=

(d) 3.484887354

F.S. sliding

CASE 6 ½ PMF w/3' Tailwater

(a) 1.542445954
(b) 8.622908772
(c) ~~0.799493007~~

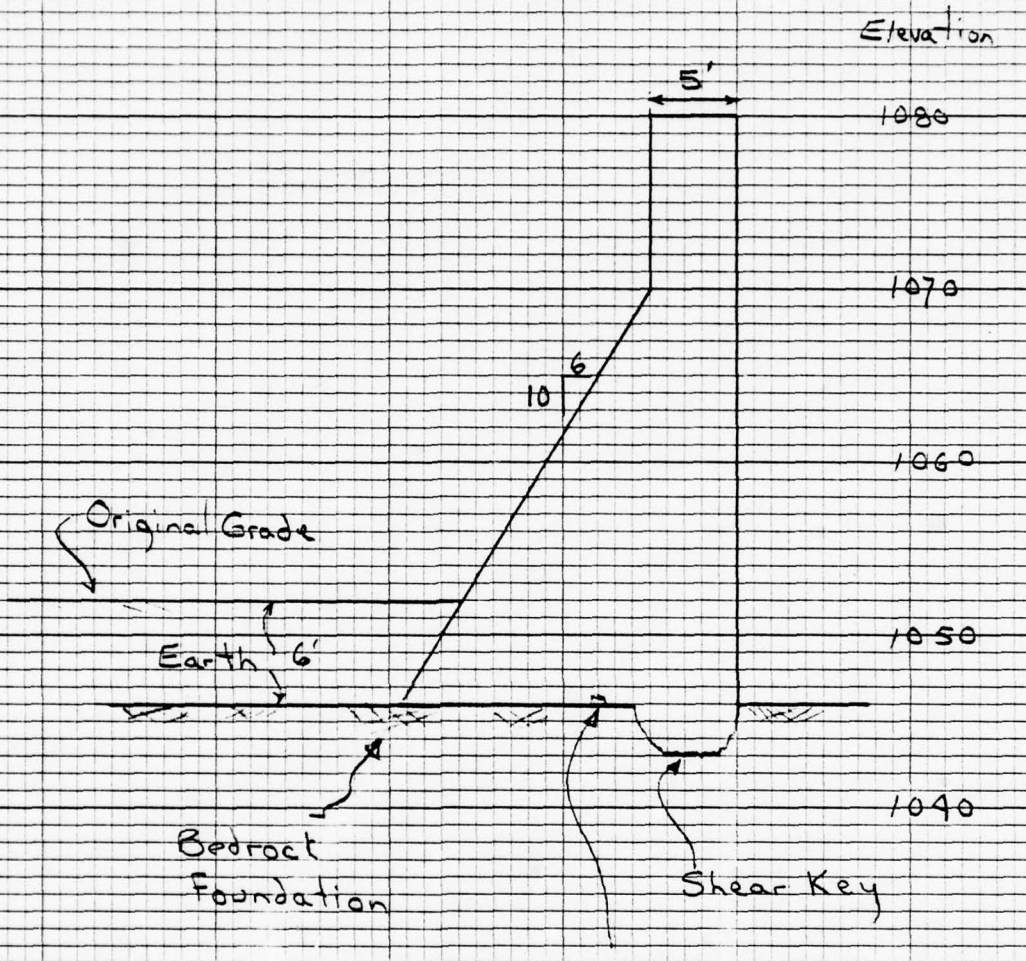
216.	+
216.	RCL
	45
54.80856	
54.80856	=
270.80856	
270.80856	÷
270.80856	(
270.80856	RCL
	29
49.92	
49.92	+
49.92	RCL
	31
18.72	
18.72	+
68.64	RCL
	9
0.	
0.	+
68.64	RCL
	36
0.	
0.	)
68.64	
68.64	=

(d) 3.945346154

F.S. sliding

Cliff Lake Dam

Nov - Overflow Section



Scale: 1" = 10'

Middle 1/3 of base ranges from 6.3' to 12.7'

INPUT FOR STABILITY ANALYSIS PROGRAM
NON-OVERFLOW SECTION

Input Parameter		Value			
		Case 1	Case 2	Case 3	Case 4
0	Unit Weight of Dam ($K/ft.^3$)	.15	.15	.15	.15
1	Area of Segment #1 ($ft.^2$)	170	170	170	170
2	Location of Center of Gravity from toe (ft.) Segment #1	16.5	16.5	16.5	16.5
3	Area of Segment #2 ($ft.^2$)	168	168	168	168
4	Location of CG from toe, Seg. #2 (ft.)	9.33	9.33	9.33	9.33
5	Area of Segment #3 ($ft.^2$)	12.5	12.5	12.5	12.5
6	Location of CG from toe, Seg. #3 (ft.)	16.0	16.0	16.0	16.0
7	Total Base Width of Dam (ft.)	19.0	19.0	19.0	19.0
8	Height of Dam (ft.)	34.0	34.0	34.0	34.0
9	Ice Loading (K/L.F.)	0	5.0	0	0
10	Coefficient of Sliding	.6	.6	.6	.6
11	Unit Weight of Soil ($K/ft.^3$)	.120	.120	.120	.120
12	Coefficient of Active Soil Pressure - Ka	0.	0.	0.	0
13	Coefficient of Passive Soil Pressure - Kp	3.5	3.5	3.5	3.5
14	Height of Water over Top of Dam (ft.)	0	0	0.9	0
15	Height of Soil for Active Pressure (ft.)	0	0	0	0
16	Height of Soil for Passive Pressure (ft.)	6	6	6	6
17	Height of Water in Tailrace Channel (ft.)	0	0	0	0

INPUT FOR STABILITY ANALYSIS PROGRAM
NON-OVERFLOW SECTION

Input Parameter		Value			
		Case 1	Case 2	Case 3	Case 4
18	Unit Weight of Water ($K/ft.^3$)	0.0624	0.0624	0.0624	0.0624
19	Area of Segment #4 ($ft.^2$)	0	0	0	0
20	Location of CG from toe, Seg. #4 (ft.)	0	0	0	0
46	Height of Ice Load or Active Water	24	23	34	31.5
49	Location of Foundation Drains from Heel (ft.)	8	8	8	8

Cliff Lake Dam
Stability Analysis
Non-Overflow Section

CASE 1 Normal Loading

(a) 2.325116212
(b) 8.576757126
(c) 1.975981571

216.	+
216.	RCL
	45
35.51076	
35.51076	=
251.51076	
251.51076	÷
251.51076	(
251.51076	RCL
	31
0.	
0.	+
0.	RCL
	29
17.9712	
17.9712	+
17.9712	RCL
	9
0.	
0.	+
17.9712	RCL
	36
0.	
0.	)
17.9712	
17.9712	=

(d) 13.99521234

CASE 2 Ice Loading

(a) 1.77115907
(b) 6.517476545
(c) 1.658258621

216.	+
216.	RCL
	45
35.66052	
35.66052	=
251.66052	
251.66052	÷
251.66052	(
251.66052	RCL
	29
16.5048	
16.5048	+
16.5048	RCL
	31
0.	
0.	+
16.5048	RCL
	9
5.	
5.	+
21.5048	RCL
	36
0.	
0.	)
21.5048	
21.5048	=

(d) 11.70252781

Cliff Lake Dam
Stability Analysis
Non-Overflow Section

CASE 3 PMF

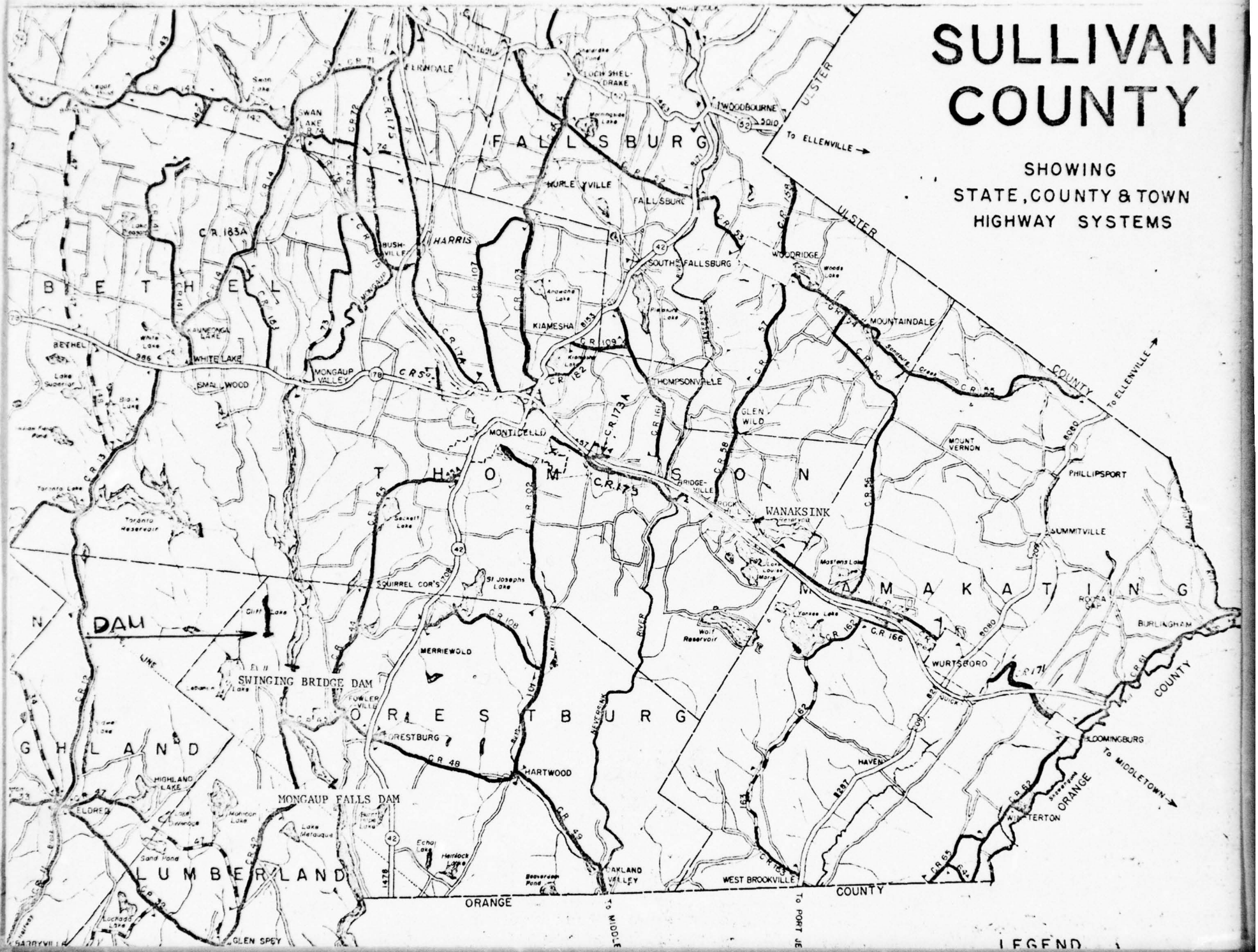
(a)	1.201471665	
(b)	2.68008634	
(c)	.8920846078	
	216.	+
	216.	RCL
		45
	33.878376	
	33.878376	=
	249.878376	
	249.878376	÷
	249.878376	(
	249.878376	RCL
		31
	1.90944	
	1.90944	+
	1.90944	RCL
		29
	36.0672	
	36.0672	+
	37.97664	RCL
		9
	0.	
	0.	+
	37.97664	RCL
		36
	0.	
	0.	)
	37.97664	
	37.97664	=
(d)	6.579791577	

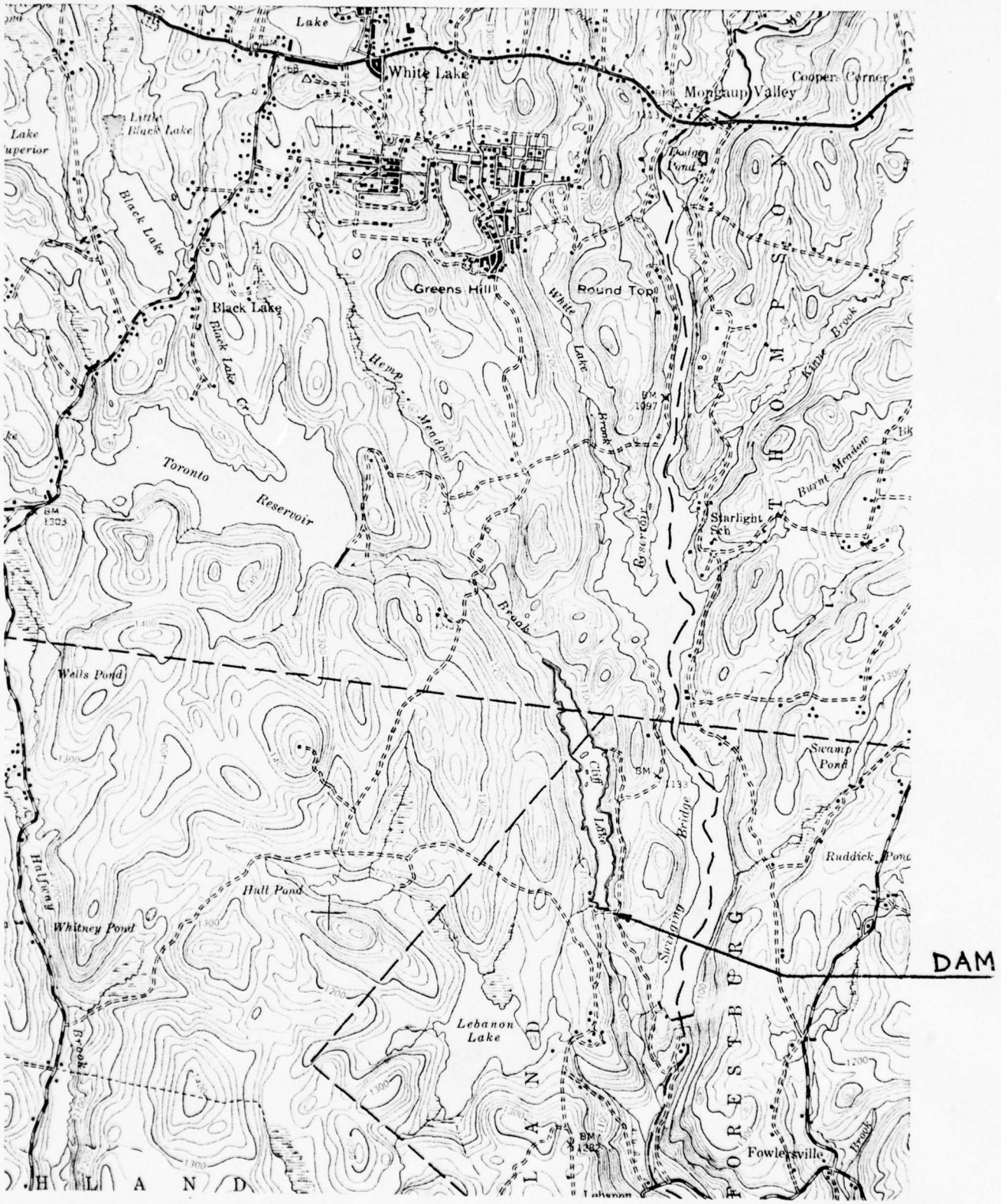
CASE 4 ½ PMF

(a)	1.462742771	
(b)	4.960185719	
(c)	1.110773882	
	216.	+
	216.	RCL
		45
	34.38756	
	34.38756	=
	250.38756	
	250.38756	÷
	250.38756	(
	250.38756	RCL
		29
	30.9582	
	30.9582	+
	30.9582	RCL
		31
	0.	
	0.	+
	30.9582	RCL
		9
	0.	
	0.	+
	30.9582	RCL
		36
	0.	
	0.	)
	30.9582	
	30.9582	=
(d)	8.087920716	

APPENDIX G

DRAWINGS


SULLIVAN COUNTY
SHOWING
STATE, COUNTY & TOWN
HIGHWAY SYSTEMS
FALLSBURG
BETHEL
THOMPSON
MAMAKATING
LUMBERLAND
HIGHLAND
FORESTBURG
DAM
SWINGING BRIDGE DAM
MONGAUP FALLS DAM
WANAKSINK
WURTSBORO
MONTICELLO
FERNDALE
LOCH SHELDRAKE
WOODBOURNE
HURLEYVILLE
SOUTH FALLSBURG
WOODRIDGE
MOUNTAINDALE
KIAMESHA
THOMPSONVILLE
GLEN WILD
MOUNT VERNON
PHILLIPSPORT
SUMMITVILLE
BURLINGHAM
BLOOMINGBURG
WHITE LAKE
SMALLWOOD
MONGAUP VALLEY
MERRIEWOLD
HARTWOOD
HAVEN
WEST BROOKVILLE
OAKLAND VALLEY
GLEN SPEY
ELDRED
BUSHVILLE
HARRIS
BRIDGEVILLE
ROCK HILL
ULSTER COUNTY
ORANGE COUNTY
To ELLENVILLE
To MIDDLETOWN
To PORT JE
LEGEND



TOPOGRAPHIC MAP

A. C. Huber

ORANGE AND ROCKLAND UTILITIES, INC.

one blue hill plaza, pearl river, new york, 10965 914-352-6000

writer's direct dial number 914-627-2420

December 7, 1978

Mr. James D. Hebson, Regional Engineer
New York Regional Office
Federal Energy Regulatory Commission
26 Federal Plaza
New York, New York 10007

Subject: Emergency Action Plan in the Event of Dam Failure at Project Nos. 2578, 2592 and 2605

Dear Mr. Hebson:

In accordance with your letter dated October 16, 1978, enclosed are three (3) copies of our revised "Monitoring and Emergency Action Plan, Mongaup River Hydroelectric Facilities." The plan provides a detailed procedure for notification of the proper authorities in the event of an emergency, including a list of telephone numbers of persons to be contacted. A contingency plan for alternate means of communication as well as documentation of correspondence with the New York State Police are also attached.

The Company Duty Officer changes each week and a copy of the Duty Officer schedule is provided to the System Operator's office. By copy of this letter the revised Emergency Action Plan is being transmitted to the Superintendent-Hydro Maintenance for immediate posting in his office. All subsequent revisions shall be likewise forwarded to him.

The revised plan includes a list of parties to be notified in the event of an emergency with the State Police having the primary responsibility and authority to effect any orderly evacuation of the areas of potential flooding. Since Orange and Rockland Utilities is the only operator of water-related facilities along the Mongaup River subject to potential flooding in the event of dam failure, the notification of other such operators is not applicable.

The Company's rigid inspection program, which is summarized in the Emergency Action Plan, affords us the opportunity to determine where repairs are required well in advance of [illegible] the critical stage. Materials necessary to effect such repairs on a

timely basis are on hand or are readily available in the area. Therefore, we do not feel the necessity to stockpile additional materials for emergency repairs.

Coordination of flows based on weather forecasts is included in instructions to System Operators. This flow coordination is designed to reduce the risk and amount of potential flooding in the downstream areas.

If we can be of further assistance to you regarding this matter, please do not hesitate to contact us.

Very truly yours,

Frank E. Fischer
Vice President

BZBjr/ct
Atts.

cc: B. Muthig, Capt. (NYS Police)

bcc: T. A. Griffin, Jr.
K. B. Field
B. Z. Baxter, Jr.
F. J. Kiernan (4 copies for distribution)
J. F. Kragh
W. H. Smith
J. O. Trudeau
K. D. Archer

ORANGE AND ROCKLAND UTILITIES, INC.

MONITORING AND EMERGENCY ACTION PLAN

MONGAUP RIVER HYDROELECTRIC FACILITIES

(Revised December 1, 1978)

Inspection Procedures Used To Monitor Condition Of Dams

Swinging Bridge, Mongaup and Rio dams are inspected daily by attendant-operators.

Toronto, Cliff Lake and Lebanon dams are inspected on Monday, Wednesday and Friday of each week by Hydro Maintenance crew members.

Each dam will be inspected once a year by a licensed Civil Engineer.

All dams are inspected every five years by consulting engineers representing the Company Bond Holders.

Other Monitoring Procedures

Pond elevations at Swinging Bridge, Mongaup and Rio are recorded by operators at these plants and relayed to Orange and Rockland System Operators at least every 4 hours during normal working hours and 24 hours per day during times of severe floods. When the new Energy Control Center goes into service in mid-1979, these elevations will be monitored continuously and automatically logged hourly at the System Operator's office in Spring Valley, New York.

Instructions to System Operators and Superintendent-Hydro Maintenance

In case of major floods (over 4 inches of rain in 24 hours or 6 inches in 48 hours), or when the in-flow at Swinging Bridge exceeds 2,000 c.f.s., Superintendent-Hydro Maintenance is instructed to close Toronto reservoir gates (if open) and start opening Swinging Bridge

flood gates at a rate which will hold the Swinging Bridge pond elevation at Elev. 1070 or less.

If the Swinging Bridge pond water elevation rises to Elev. 1071, the top 1.2 feet of flashboards will release over the 125 foot length of boards. When this condition occurs the Superintendent-Hydro Maintenance shall notify the System Operator. The System Operator shall notify the New York State Police that a possible emergency condition is imminent and request that Police stand by, but take no action until further notice. If this release by the top 1.2 feet of flashboards does not cause a drop in the elevation of the Swinging Bridge pond, or if the pond again rises to Elev. 1071, the Superintendent-Hydro Maintenance shall notify the System Operator who will notify the State Police to evacuate the houses in Mongaup Village at the lower end of the Mongaup River. The System Operator shall notify the Company Duty Officer, Manager-Electric Production, and Security Manager of the emergency condition and the action taken. The System Operator shall notify the New York Regional Engineer of the Federal Energy Regulatory Commission or his alternate.

If Swinging Bridge pond level continues to rise to above Elev. 1072, the remaining 5.0 feet of flashboards will be released and the maximum spillway capacity will then be available. The sill of this spillway is at Elev. 1065.

The operation of the entire flashboard system with all gates wide open should control the Swinging Bridge pond level for any anticipated flood. If after the operation of the entire flashboard system the pond level does not drop below Elev. 1071, the Superintendent-Hydro Maintenance shall notify the System Operator who will notify the State Police to evacuate the remaining endangered properties located immediately down-

stream of the Mongaup dam and the Rio recreation area. Notification of the Duty Officer, Manager-Electric Production, Corporate Communications, and Security Manager shall also be accomplished.

In the event, during an emergency condition, the Superintendent-Hydro Maintenance cannot make telephone contact with the System Operator, he shall use the Company two-way radio system. If the System Operator cannot make telephone contact with the State Police, he shall request a messenger with a radio vehicle be immediately dispatched from the Company's Western Division Operations Center in Middletown, New York to go directly to the State Police headquarters, also located in Middletown, to notify them of the emergency condition. The messenger shall remain at police headquarters to maintain direct radio contact between the Superintendent-Hydro Maintenance, System Operator, and the State Police.

BZBjr/ct 12/1/78

MONGAUP RIVER HYDROELECTRIC FACILITIES

EMERGENCY ACTION PLAN

NOTIFICATION LIST

New York State Police		(914) 343-1424
Superintendent-Hydro Maintenance Joseph B. Case	Office: Home:	(914) 856-2109 (914) 754-8271
Manager-Electric Production Frank J. Kiernan	Office: Home:	(914) 352-6000, X-441 (914) 342-0521
Security Manager John F. Kragh	Office: Home:	(914) 352-6000, X-558 (914) 496-4964
Corporate Communications John P. Murphy	Office: Home:	(914) 627-2473 (914) 942-0246
Federal Energy Regulatory Commission New York Regional Engineer James Hebson	Office: Home:	(212) 264-3687 (201) 998-2845
Chief Civil Engineer (Alternate) Martin Inwald	Office: Home:	(212) 264-3687 (516) 285-5964
Operations Duty Officer		(See Operations Duty Officer Schedule and Guidelines)

12/1/78

In answering this, please use the same subject heading as on this letter

Subject Monitoring and Emergency Action Plan

To FILE

From B. Z. Baxter, Jr.

cc: Mr. F. E. Fischer
Mr. J. Kragh
Mr. K. B. Field

July 14, 1978

On July 7, 1978 a meeting was held at the New York State Police Headquarters, Troop F, in Middletown, New York to review our June 30, 1978 submittal of subject plan to the Federal Energy Regulatory Commission. Attendees were J. Kragh (O&R), B. Z. Baxter, Jr. (O&R), B. Muthig, Capt. (NYS Police) and J. McMahon, Lt. (NYS Police).

Since we had forwarded a copy of the plan to the NYS Police prior to the meeting, only a short discussion as to the purpose of the plan and the function of the State Police was required. We advised that they were the only group being asked to coordinate this Emergency Action Plan in the event implementation was necessary and we would forward them a list of residences not controlled by O&R that would be affected in the Mongaup Village area. The State Police felt that since there were few residences involved, notification would not be difficult.

They were informed that any changes in the Emergency Action Plan would be forwarded to them as they occurred.

The meeting was highly productive since we will be able to obtain their cooperation.

B. Z. Baxter

BZBjr/ct B. Z. Baxter, Jr.

914-627-2609

July 17, 1978

Blake Muthig, Captain
New York State Police
Troop F
Middletown, New York 10940

Subject: Monitoring and Emergency Action Plan
Mongaup River Hydroelectric Facilities

Dear Captain Muthig:

As agreed during our July 7, 1978 meeting, attached is a list of residences in the Mongaup Village area not controlled by Orange and Rockland which could be flooded due to upstream dam failure. We also attach a drawing showing location of the homes with respect to the expected area of flooding.

In the event of any changes in the Emergency Action Plan, you will be promptly notified.

Very truly yours,

B. Z. Baxter, Jr.
Assistant Vice President

BZBjr/ct
Atts.

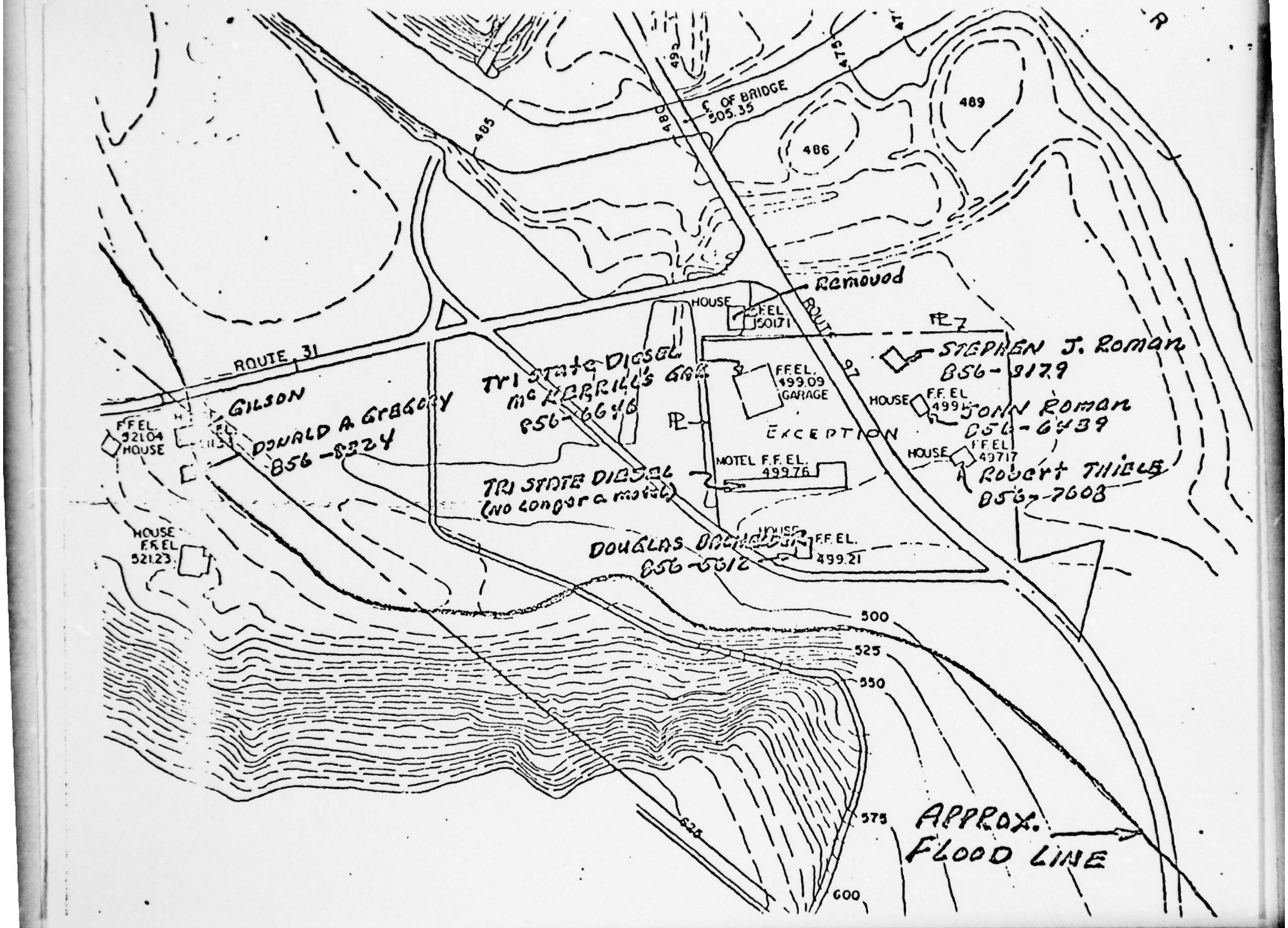
cc: Mr. J. Kragh

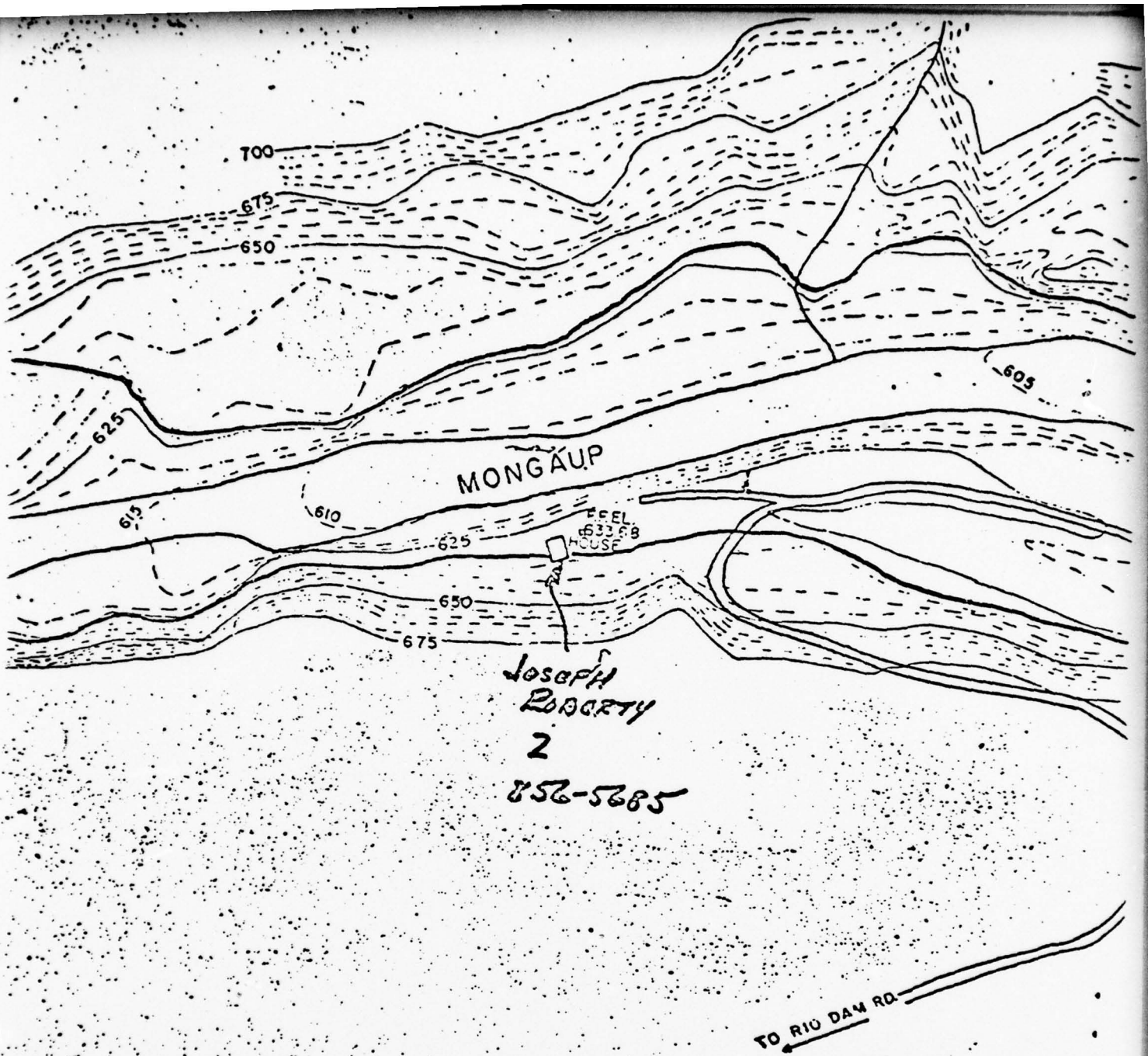
bcc: Mr. F. E. Fischer
Mr. K. B. Field

Mongaup Village Residences

Not Controlled By O&R

Donald A. Gregory	856-8324
Tri State Diesel McKerrill's Garage	856-6646
Gilson	No Phone Listed
Douglas Bachelder	856-5612
Stephen J. Roman	856-3179
John Roman	856-6439
Robert Thiele	856-7608
Joseph Roberty	856-5685


ROUTE 31
GILSON
DONALD A GREGORY
856-8324
FF EL 521.04 HOUSE
HOUSE FF EL 521.23
TRI STATE DIESEL
McLERRIE'S GAS
856-6646
TRI STATE DIESEL
(NO LONGER A MOTEL)
MOTEL F.F. EL. 499.76
F.F. EL. 499.09 GARAGE
HOUSE F.F. EL 501.71
Removed
ROUTE 97
EXCEPTION
STEPHEN J. ROMAN
856-9179
HOUSE F.F. EL 499
JOHN ROMAN
856-6439
HOUSE F.F. EL 497.17
ROBERT THIELE
856-7608
DOUGLAS
856-5512
F.F. EL. 499.21
℄ OF BRIDGE 505.35
485
486
489
500
525
550
575
600
APPROX. FLOOD LINE


700
675
650
625
605
MONGAUP
615
610
625
650
675
ELEV. 633 FT.
HOUSE
Joseph
Rogers
2
852-5685
TO RIO DAM RD.

COMPANY OPERATIONS
DUTY OFFICER
GENERAL GUIDELINES

PURPOSE

To provide for the availability of a person of sufficient rank to act in the capacity of Company spokesman and provide high level management direction, if required in the event of an incident or accident within the Company which would have a significant impact in terms of our customers, the general public, regulatory agencies, news media and other interested publics. This is consistent with our Company Policy of providing continuous service to our customers in a safe and efficient manner.

To provide an equitable distribution of Operating Department responsibilities during those periods outside of the normal business hours.

To provide the opportunity for the exposure of the Duty Officer to all facets of operations, thereby developing understanding, appreciation and flexibility of personnel within the Company.

GENERAL GUIDELINES

1. Copies of the Duty Officer Schedule for Company operations will be made available to the Service Operator Supervisor and Service Operators to facilitate contacting the appropriate person when an incident or accident occurs which may have a significant impact on the Company.

2. Persons scheduled for duty may change with other parties on the Duty Officer Schedule and will be obligated to inform the Service Operator Supervisor of such change.

3. The availability of the Duty Officer will be required during the entire week that the person is scheduled. Availability is not construed to mean that the person must stay at home by the telephone. However, it does mean that the person may be contacted in a timely fashion.

4. The person designated as Duty Officer for the week will act as the Company spokesman concerning any incident or accident that occurs during that week, until such time as another appropriate individual becomes available to act as the Company spokesman.

5. The availability of a Duty Officer will not supersede or change established procedures for emergency notification of functionally responsible Officers or other personnel.

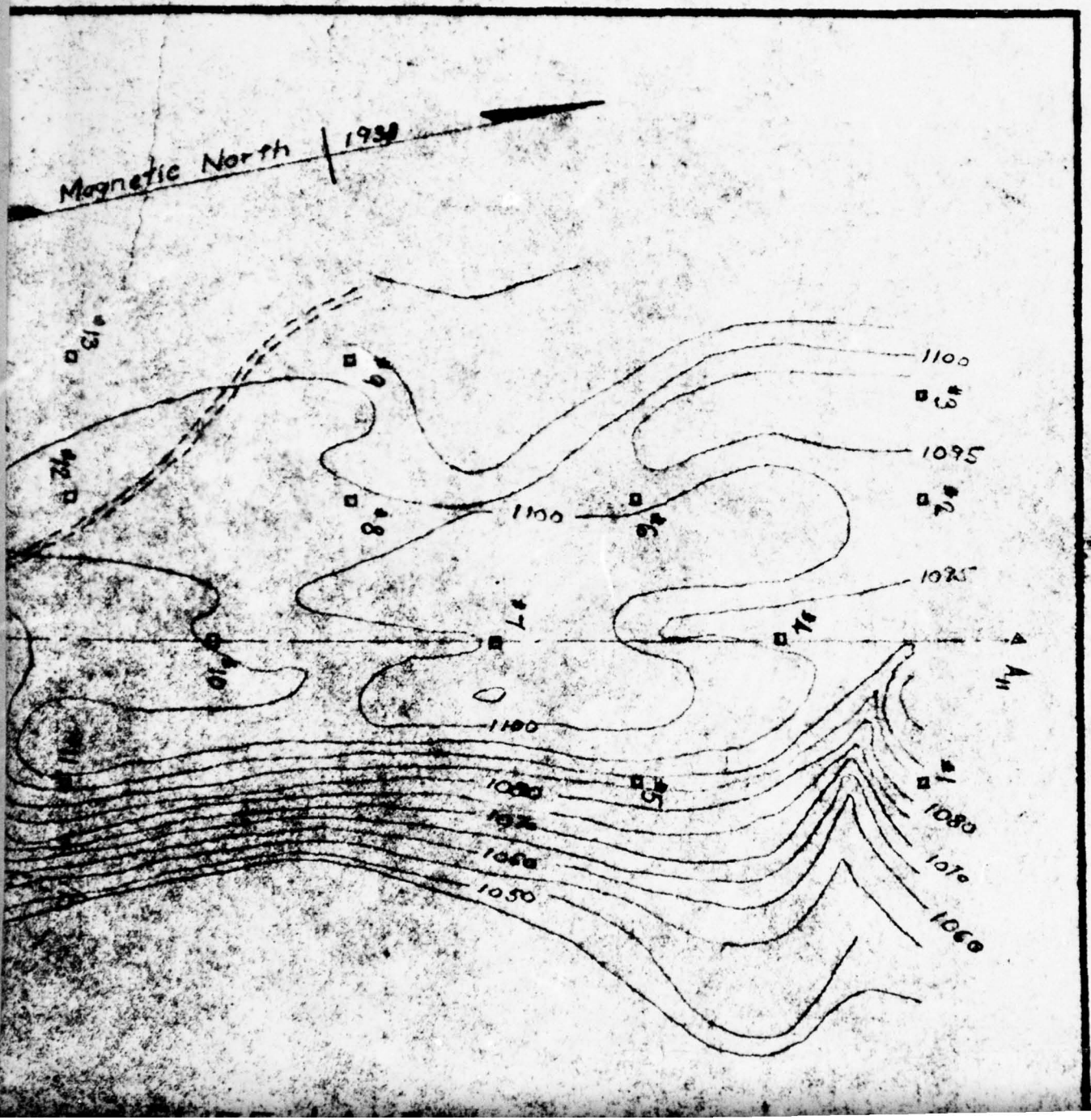
GENERAL GUIDELINES - (Continued)

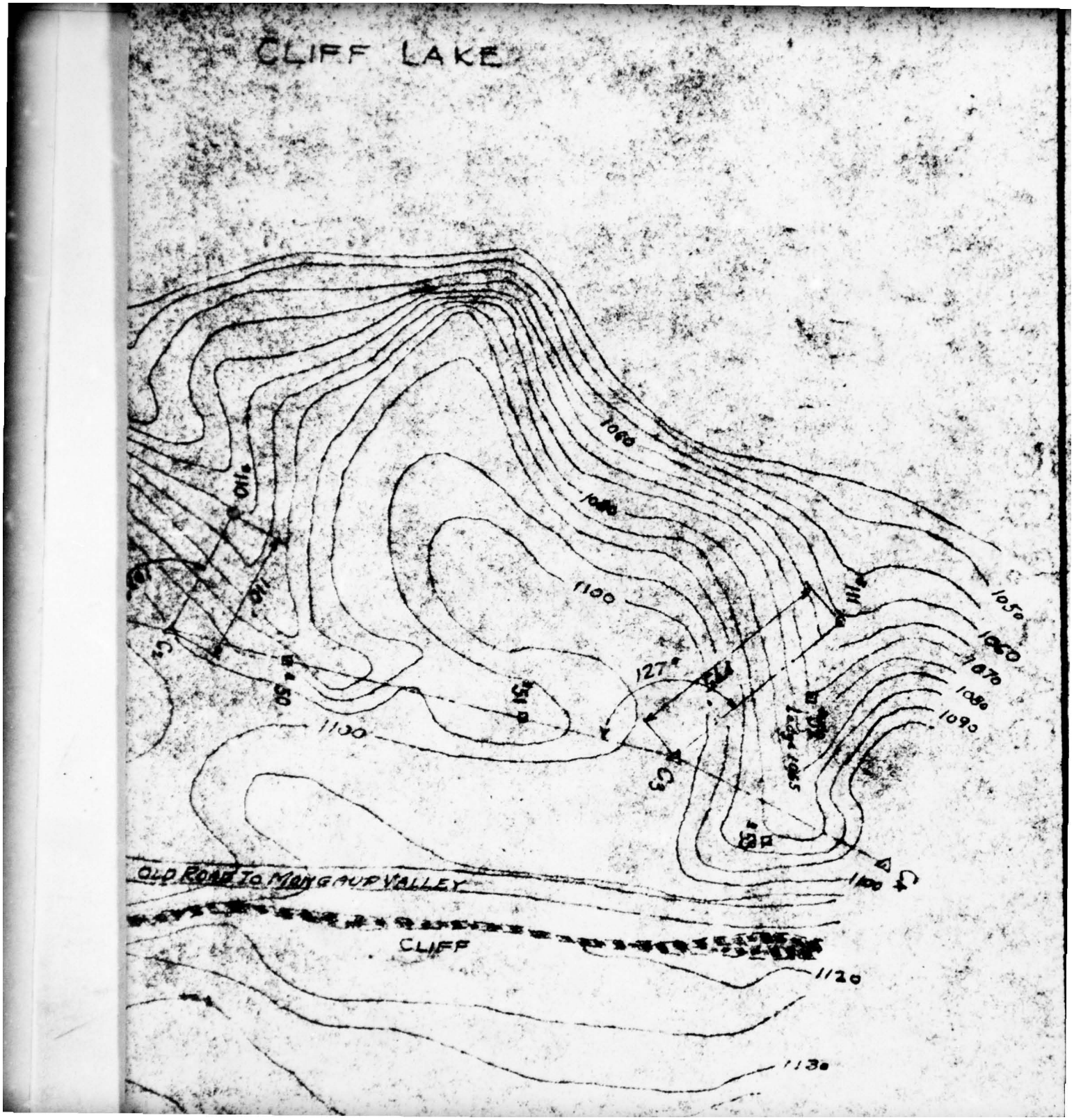
6. The Duty Officer shall act as the liaison authority across all departments, such as Transportation, Stores, etc. during the period outside of normal business hours. Problems which may develop after the standard Operating Procedures have been exhausted at lower levels of management, concerning the coordination of support services will be resolved by the Duty Officer.

7. Included with the Duty Officer Schedule are Emergency Procedures that are to be followed either by the Standby Duty Supervisor and/or persons within the operating departments in compliance with established requirements. It shall be the responsibility of the Duty Officer to ensure that these requirements are accomplished in a timely manner.

List of Drawings
Cliff Lake Dam

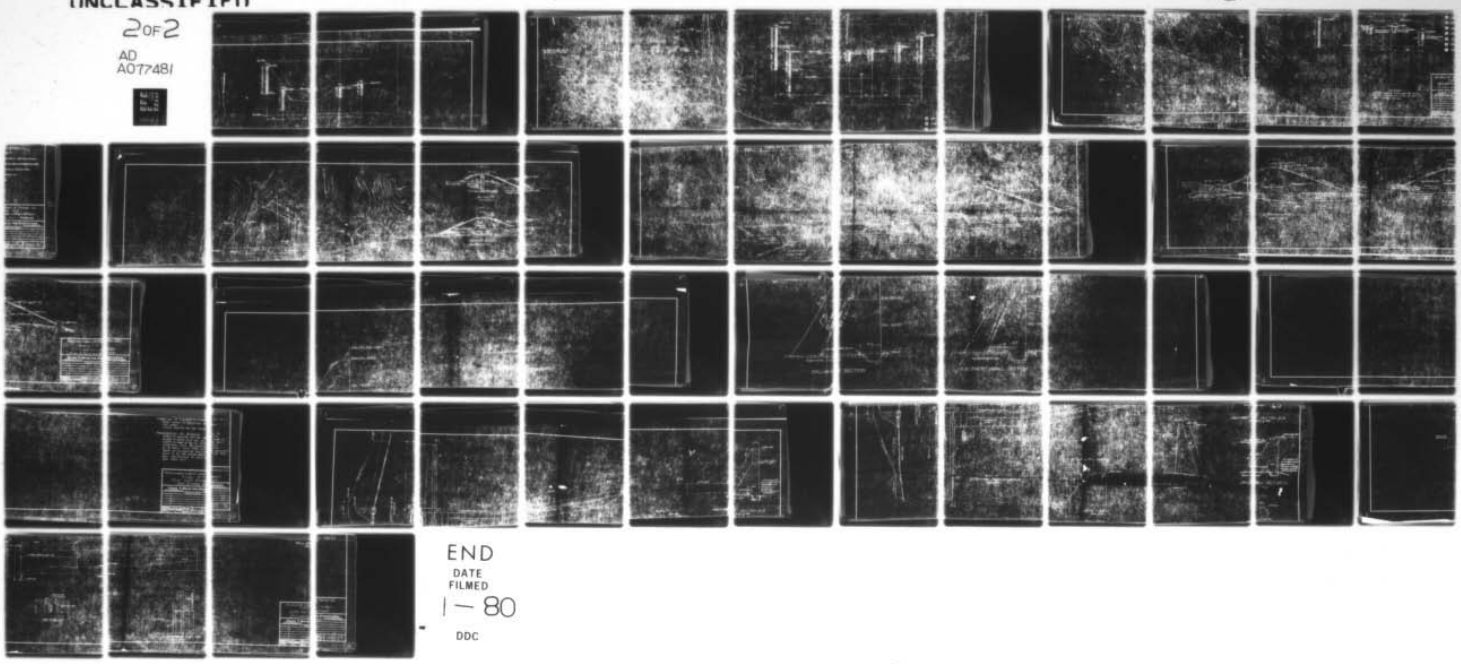
Description	Drawing No.
Cliff Lake Dam - Borings	1300-52
Plan & Sections of Dam	1300-55
Dam Stress Sheet	1300-56
Spillway & Abutments	1300-57


Magnetic North
1950
1100
1095
1100
1085
1100
1080
1070
1060
1050
A_H

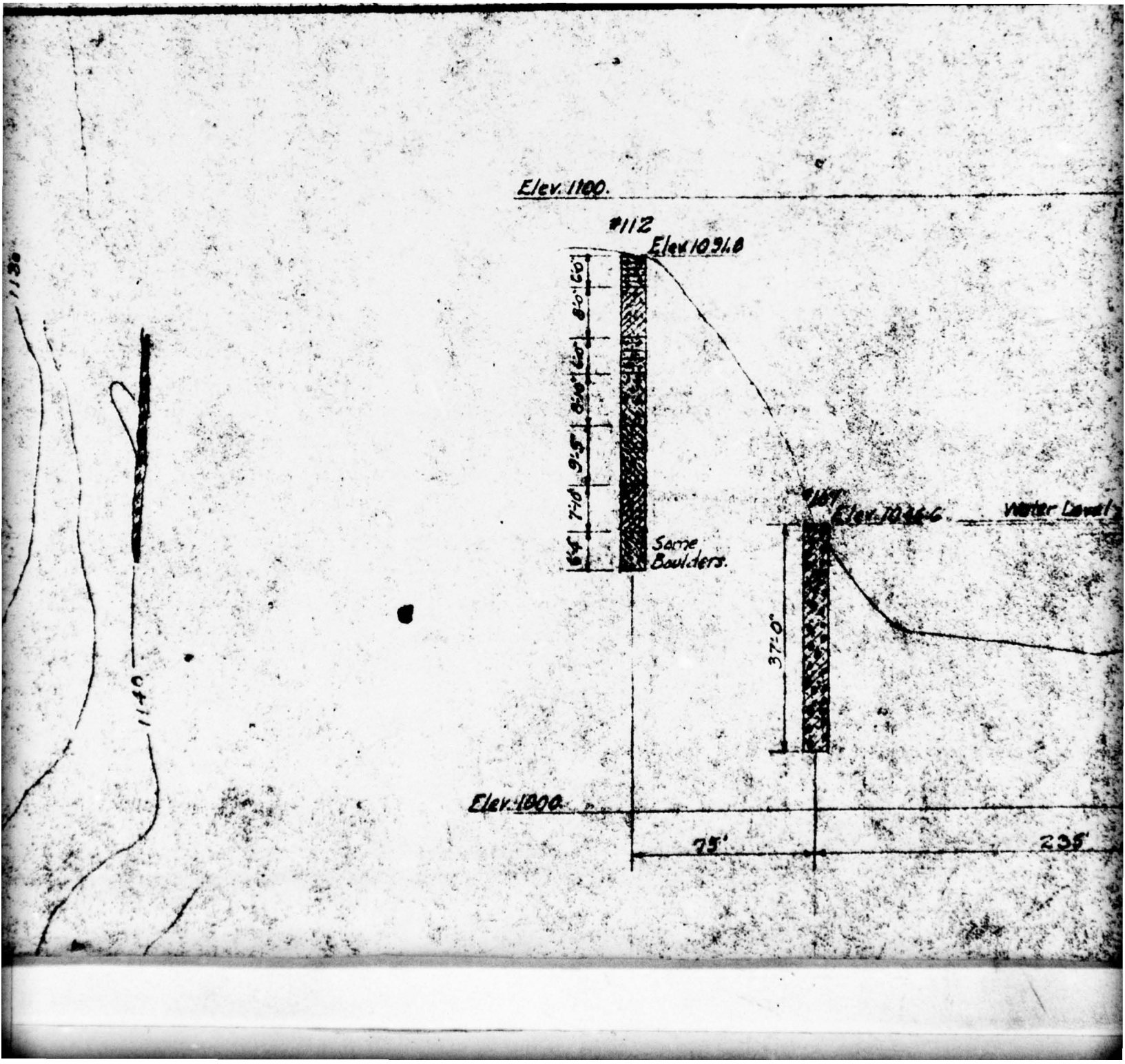

CLIFF LAKE
1060
1080
1100
1050
1070
1090
1120
1130
127°
OLD ROAD TO MANGAUP VALLEY
CLIFF

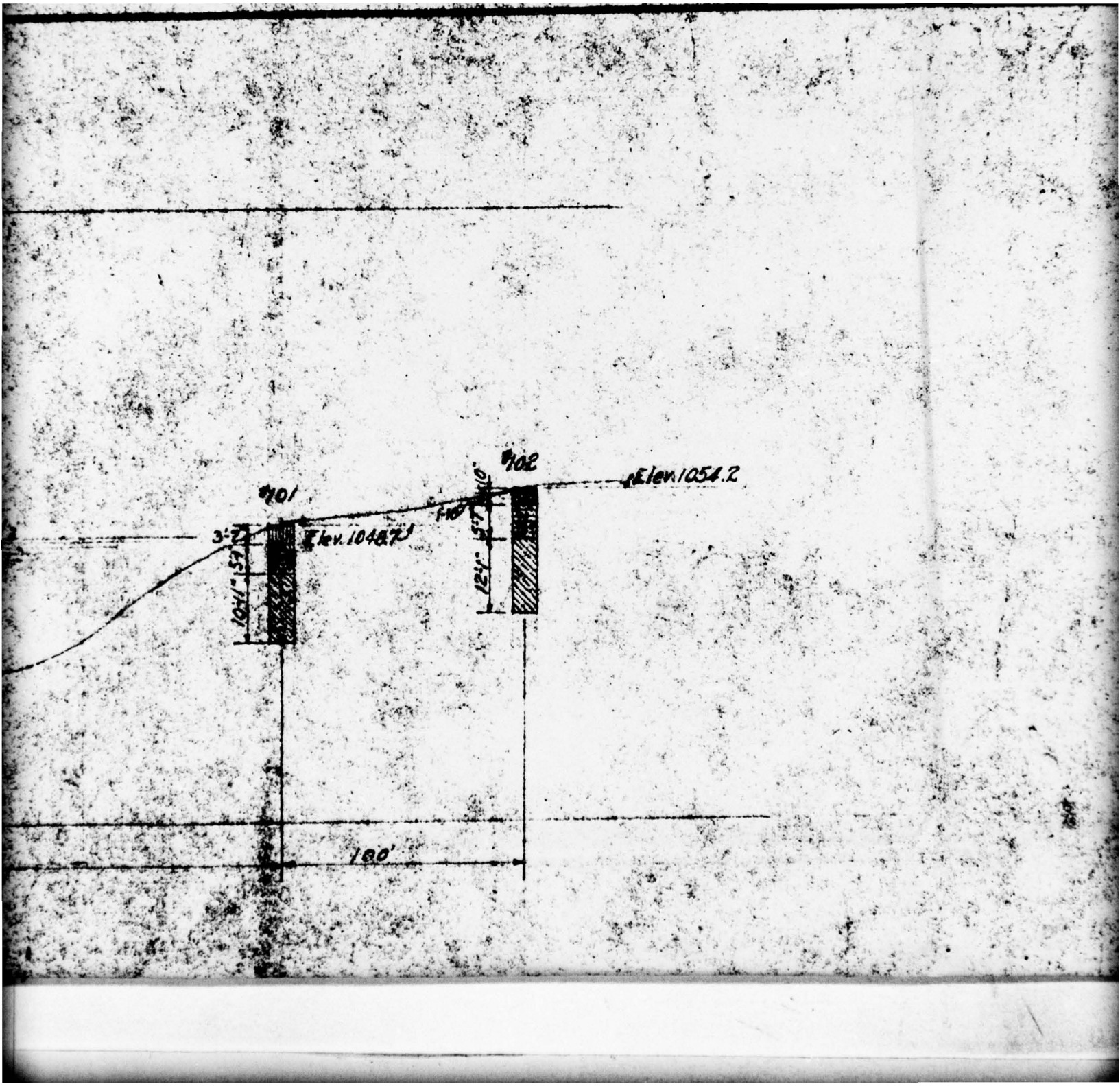
AD-A077 481 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. CLIFF LAKE DAM (INVENTORY NUMBER N--ETC(U)
SEP 79 G KOCH DACW51-79-C-0001
UNCLASSIFIED NL

2 OF 2
AD
A077481

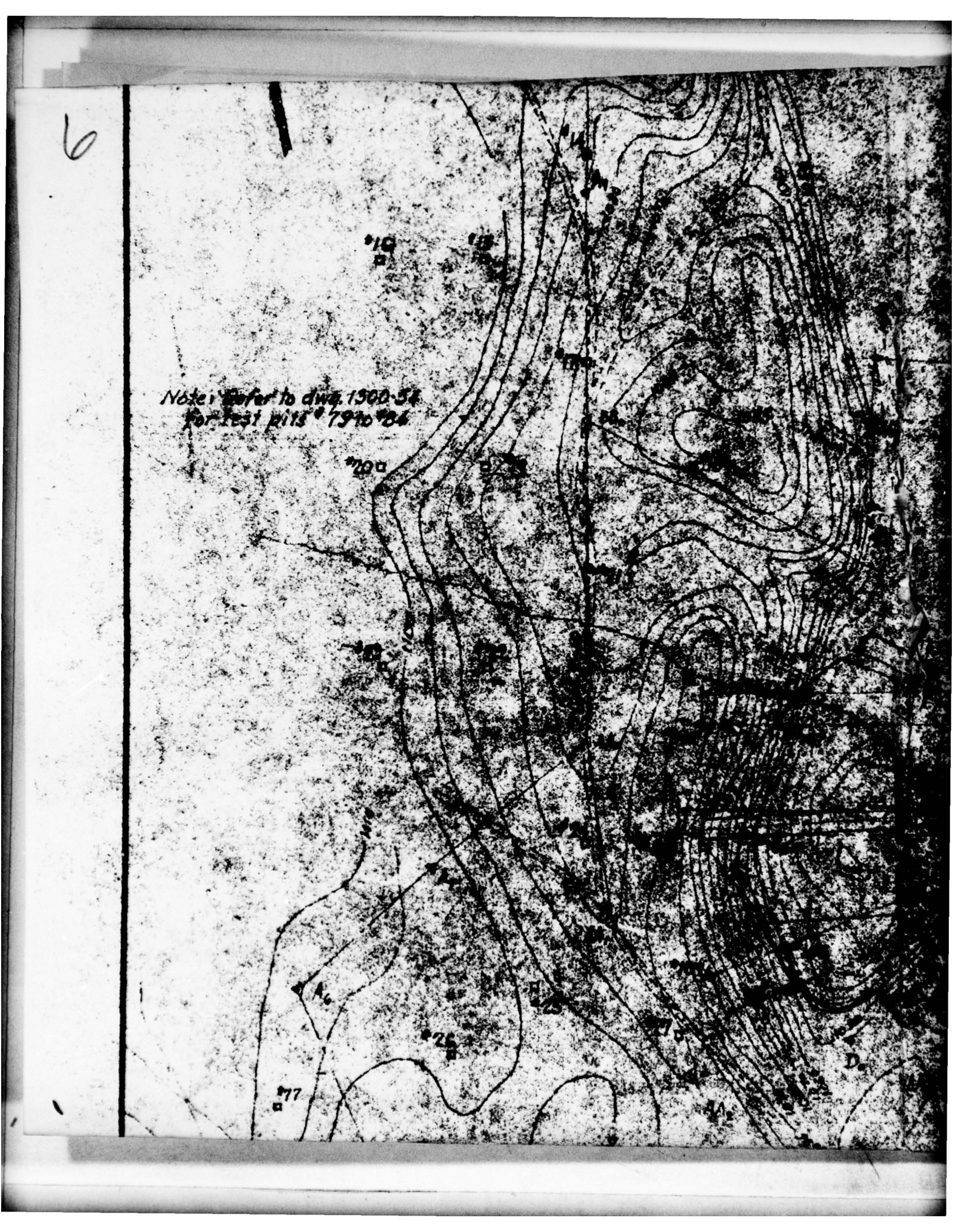


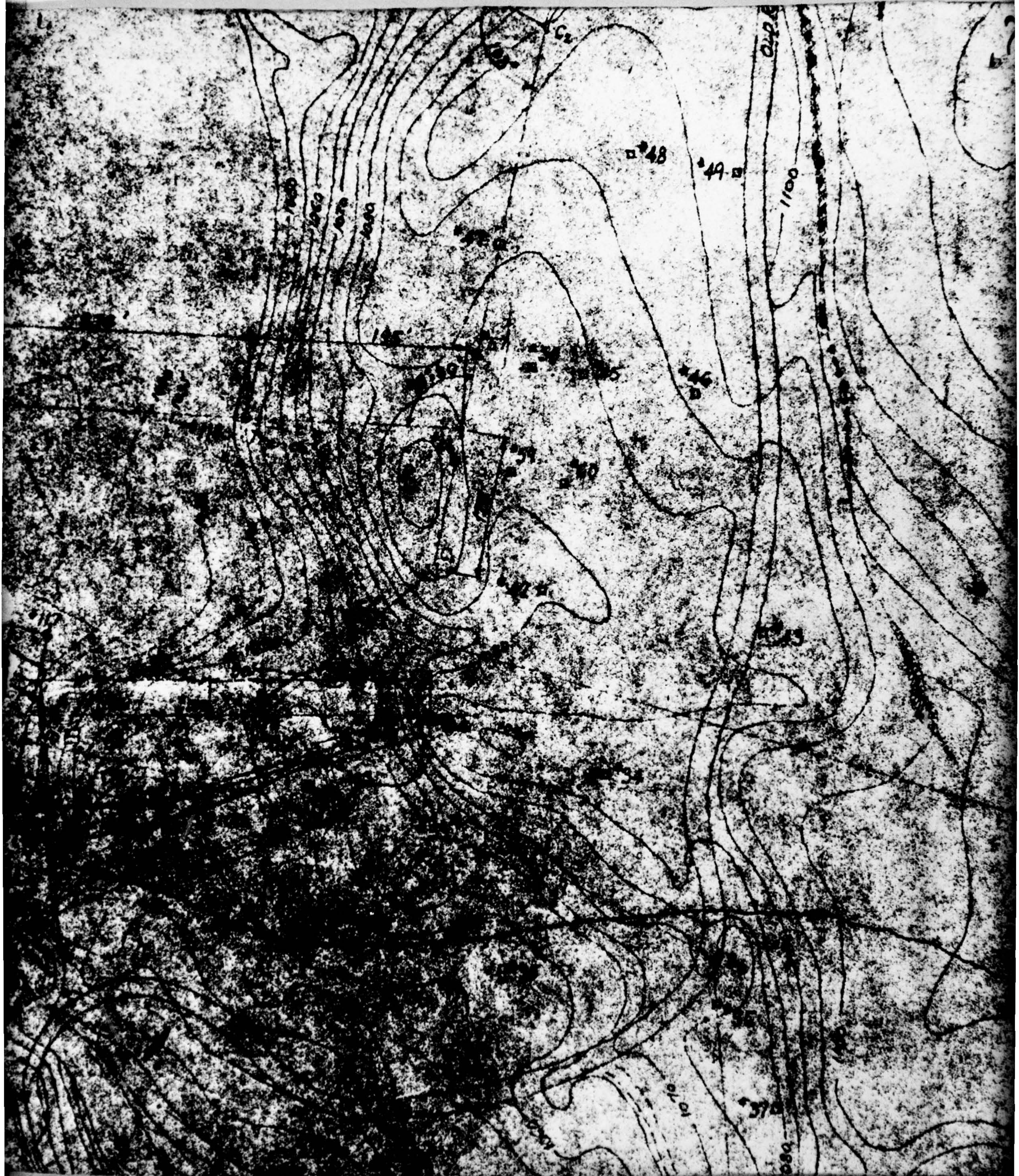
END
DATE
FILMED
1-80
DDC

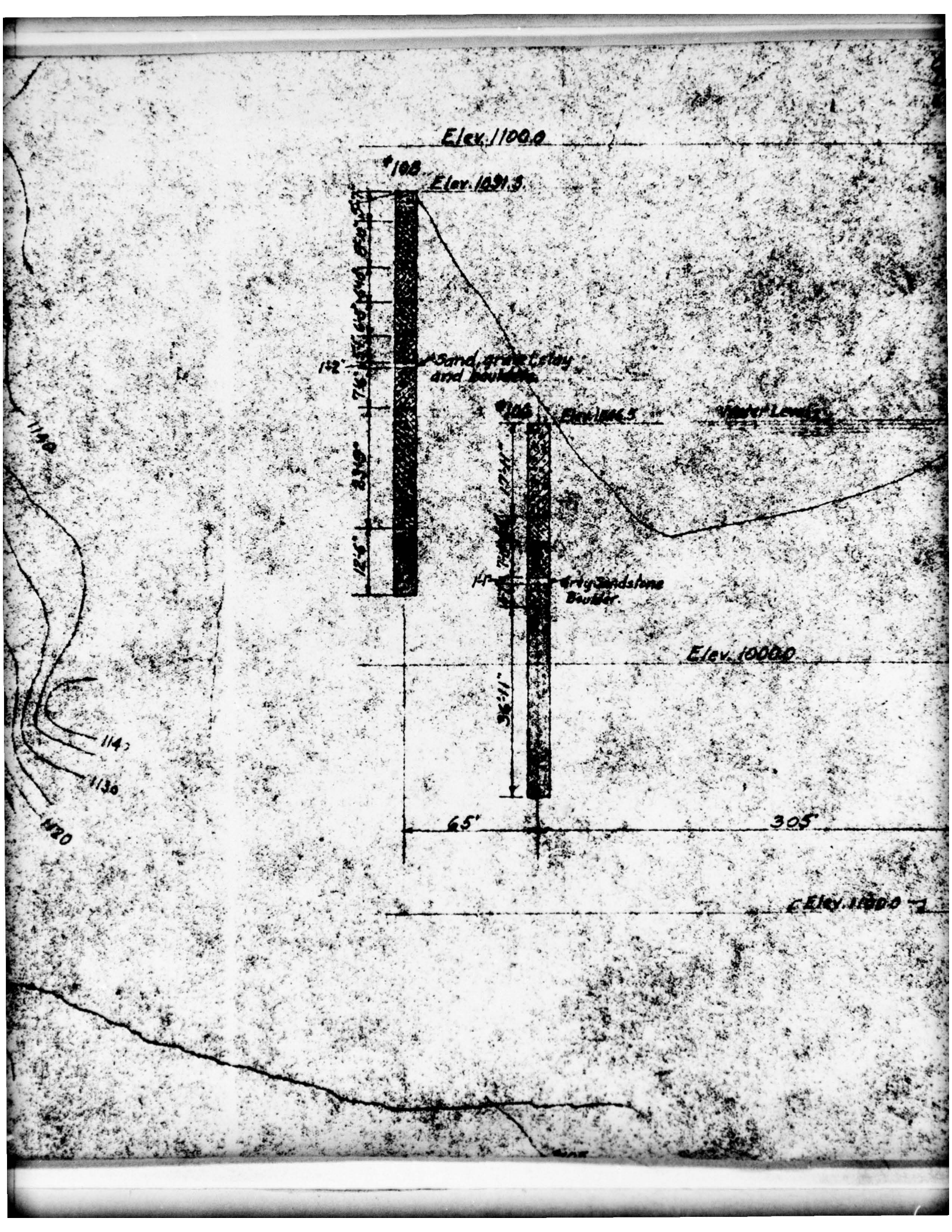

Elev. 1100.
#112
Elev 1094.0
6'-6"
7'-0"
9'-5"
8'-0"
8'-0"
Same Boulders.
#107
Elev. 1044.6
Water Level
37'-0"
Elev. 1000
75'
235'
1130
1140

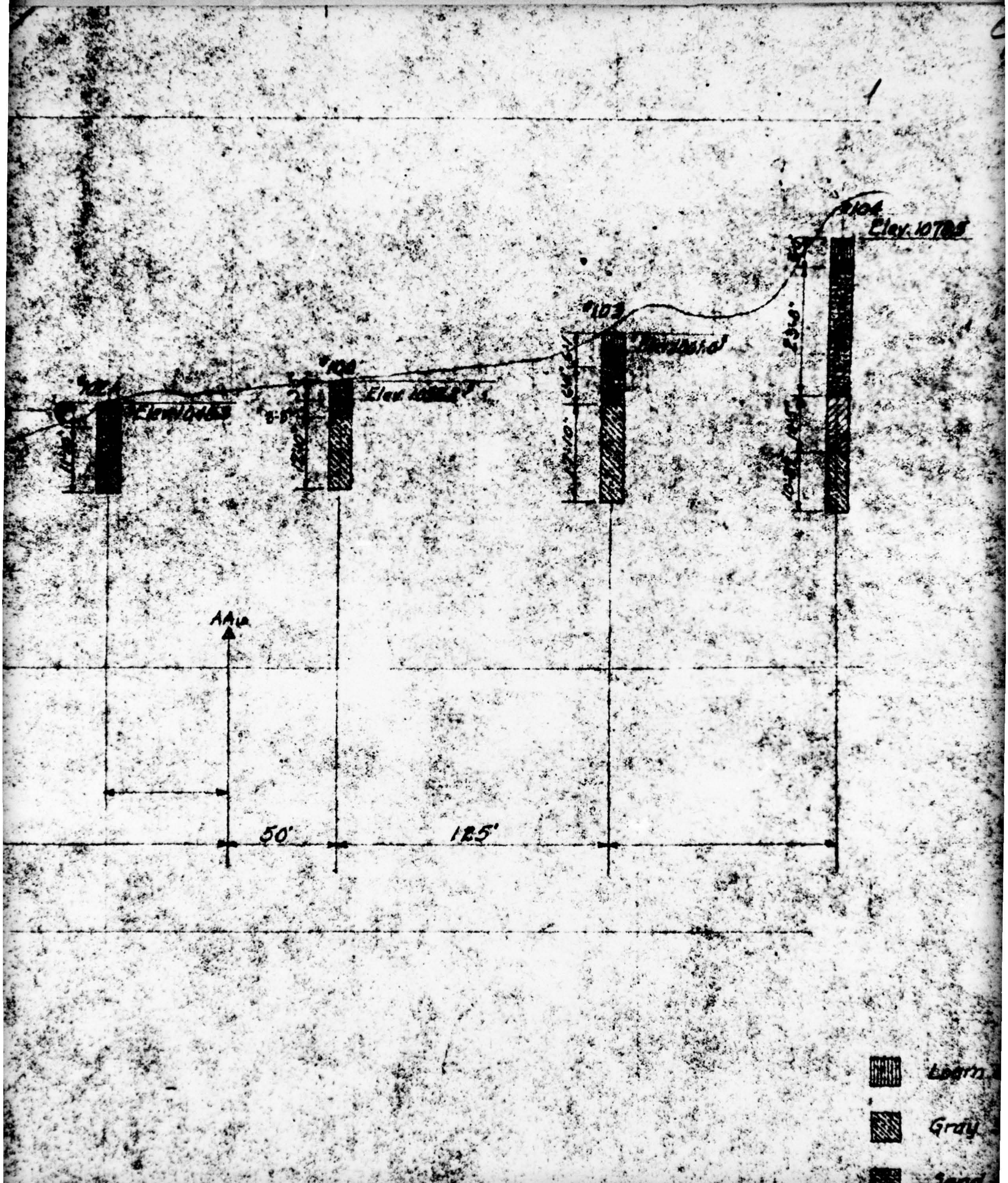

#102
℄Elev.1054.2
#101
1'-0"
1'-6"
3'-2"
℄Elev.1048.2
10'-1½"
5'-1"
12'-1"
100'

5


Note: Refer to dwg. 1300-54
for test pits #79 to #84


48
49
1100
46
40


Elev. 1100.0
#108
Elev. 1091.3
Sand, gravel, clay and boulders
#106
Elev. 1086.5
Water Level
Elev. 1000.0
65'
305'
Elev. 1000.0
1140
1130
1120


#103
#104
Elev. 10785
AAia
50'
125'
Gray
Sand

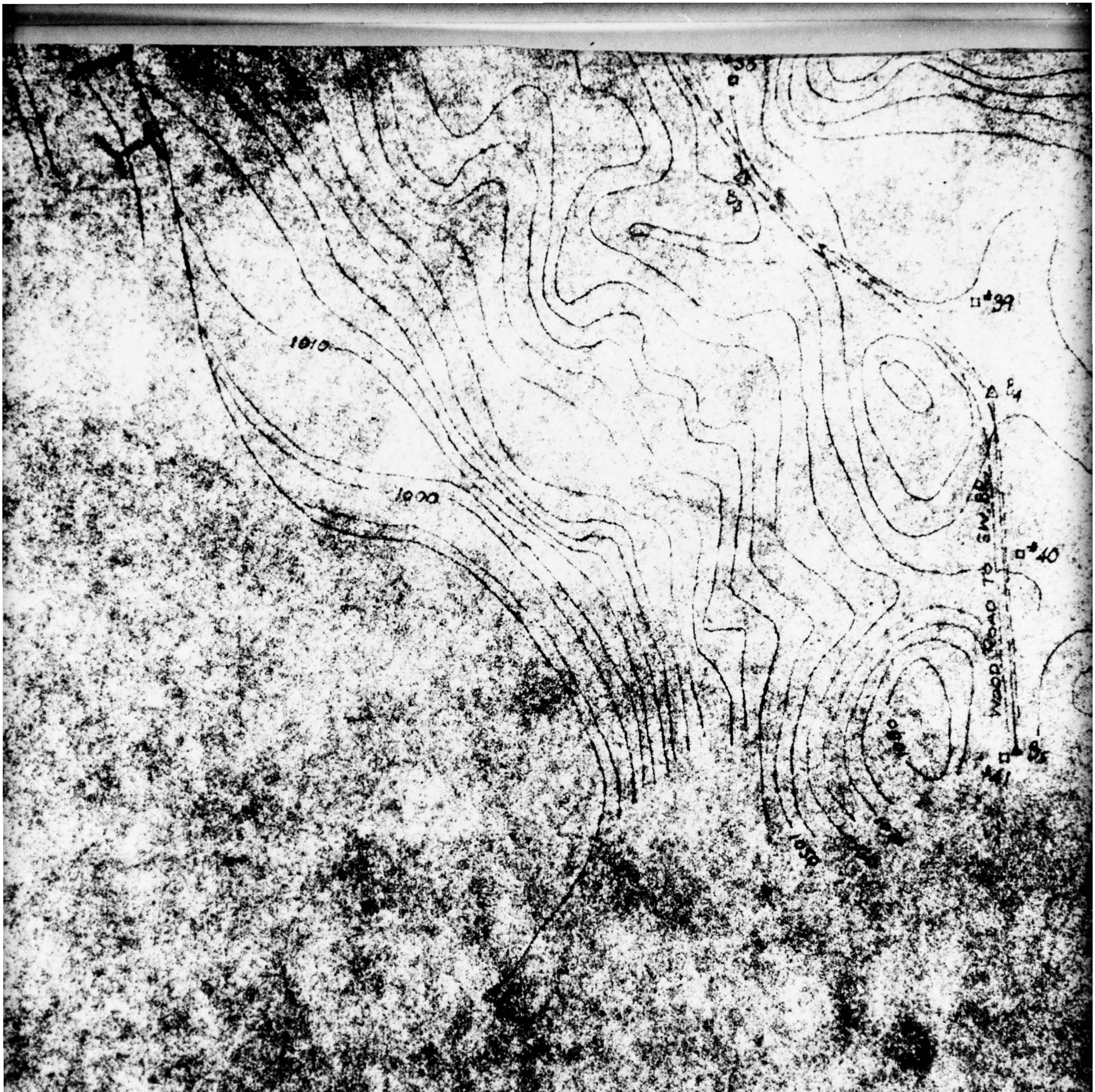
10

Soil.

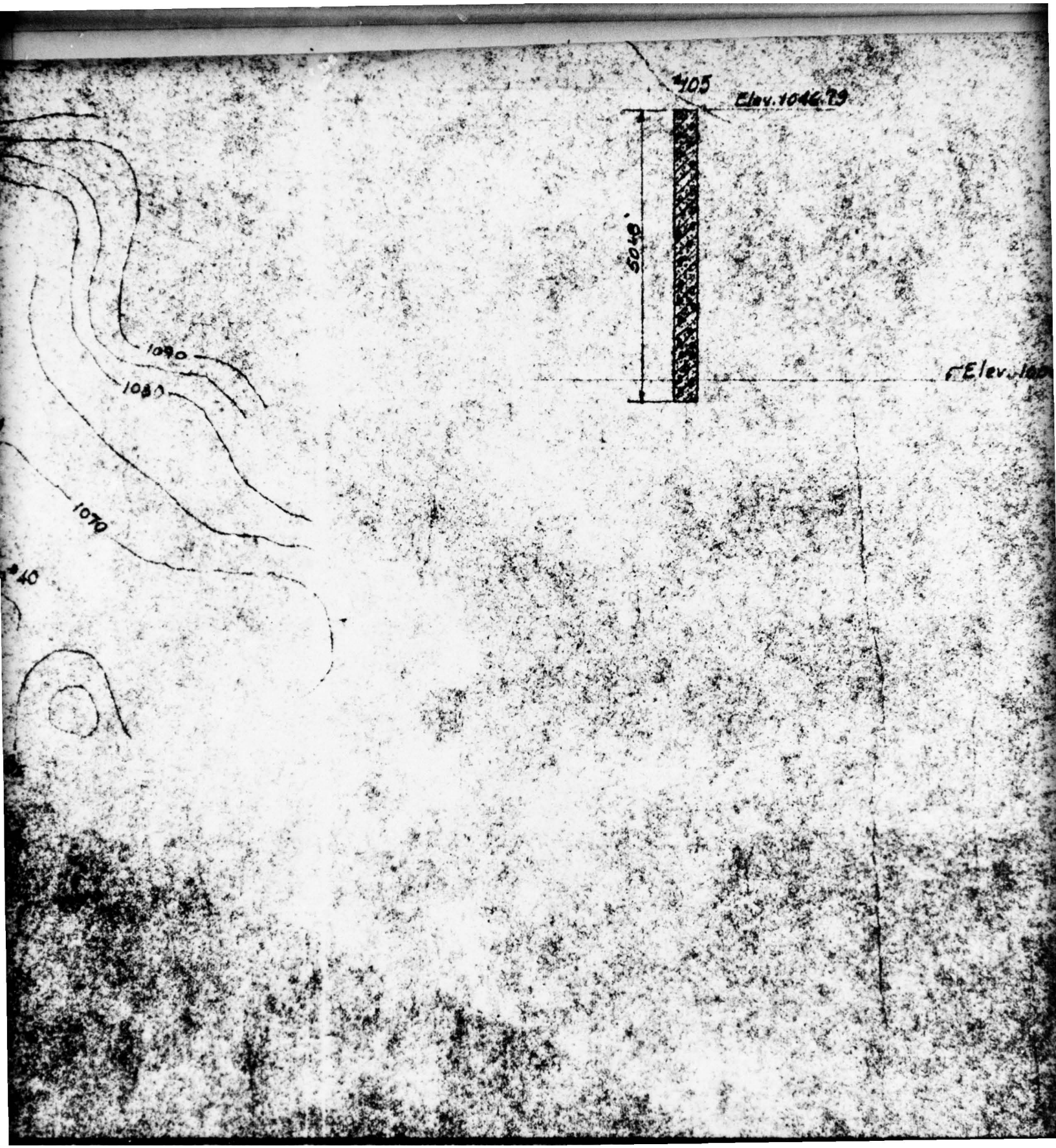
clay.

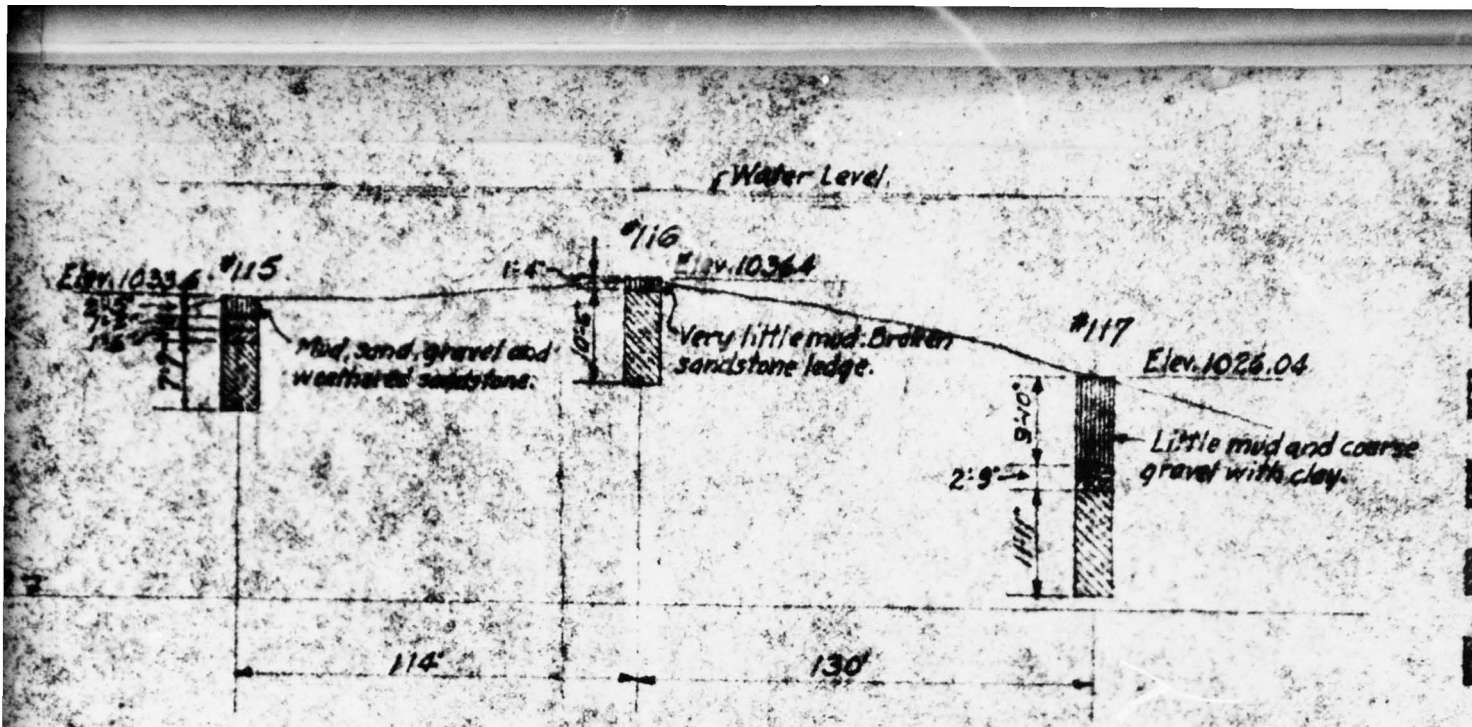
Note Test pit #5 is 200 ft. south of #67.
Test pit #68 is 425 ft. south of #67.

11



1010
1000
#39
#40
WOOD ROAD TO SW. BR.
1030


405
Elev. 1046.79
5040'
Elev. 100
1090
1080
1070
40



Sa
Sh
Sa
Gr
Sa
Sa
Cl

ROCKLAND L
NYA
CLIFF L
CLIFF LA

CHAS. T. M
881 DEVONSHIRE ST.

IN CHARGE OF W. E. UHL
DRAWN | TRACED | CHECKED
L.G.R.

LEGEND

- ⊙ #105 — Location and number of boring
- ⊡ #24 — Location and number of test pit
- Ledge outcrop

d, gravel and clay.

le.

d, gravel, clay and boulders.

vel; boulders and decayed sandstone.

d, gravel and boulders.

d and clay.

y.

Stone
10 2 A
Bowlder

IGHT & POWER CO.
CK, N.Y.
F. DEVELOPMENT
E DAM - BORINGS

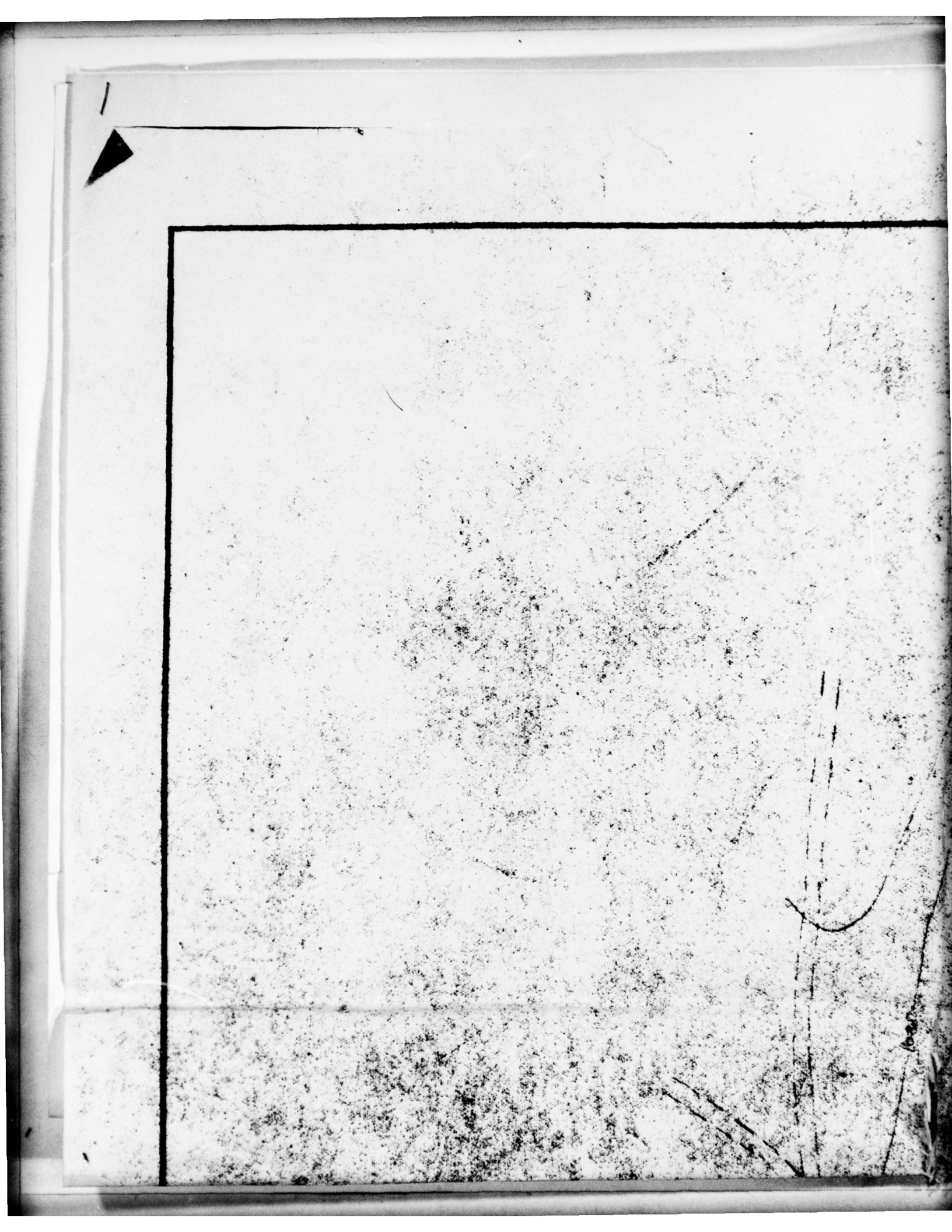
AIN, INC., ENGINEERS.
BOSTON, MASS. U.S.A.

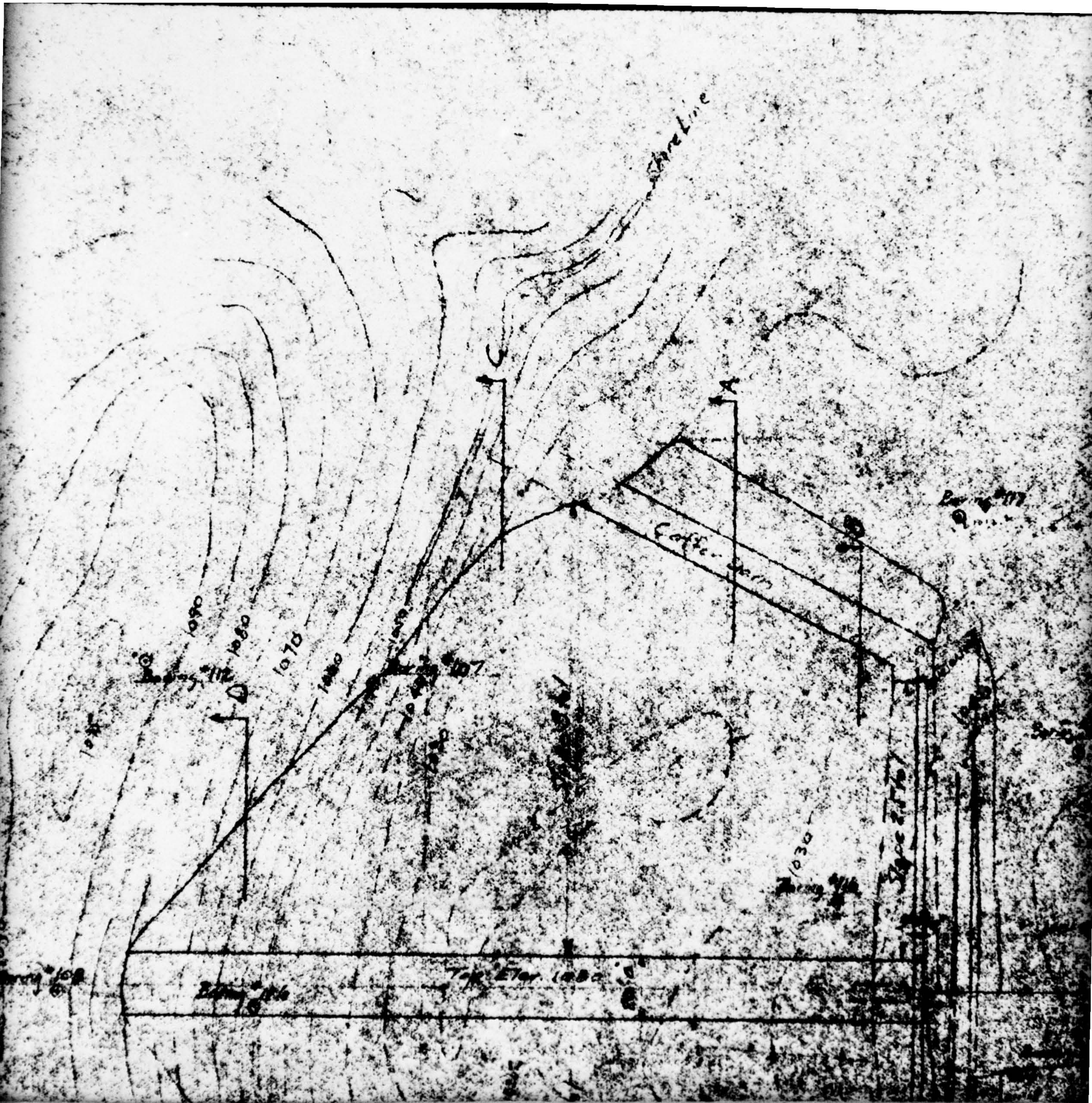
REVISIONS

SCALE 1" = 100'
DATE MAY 2, 1938

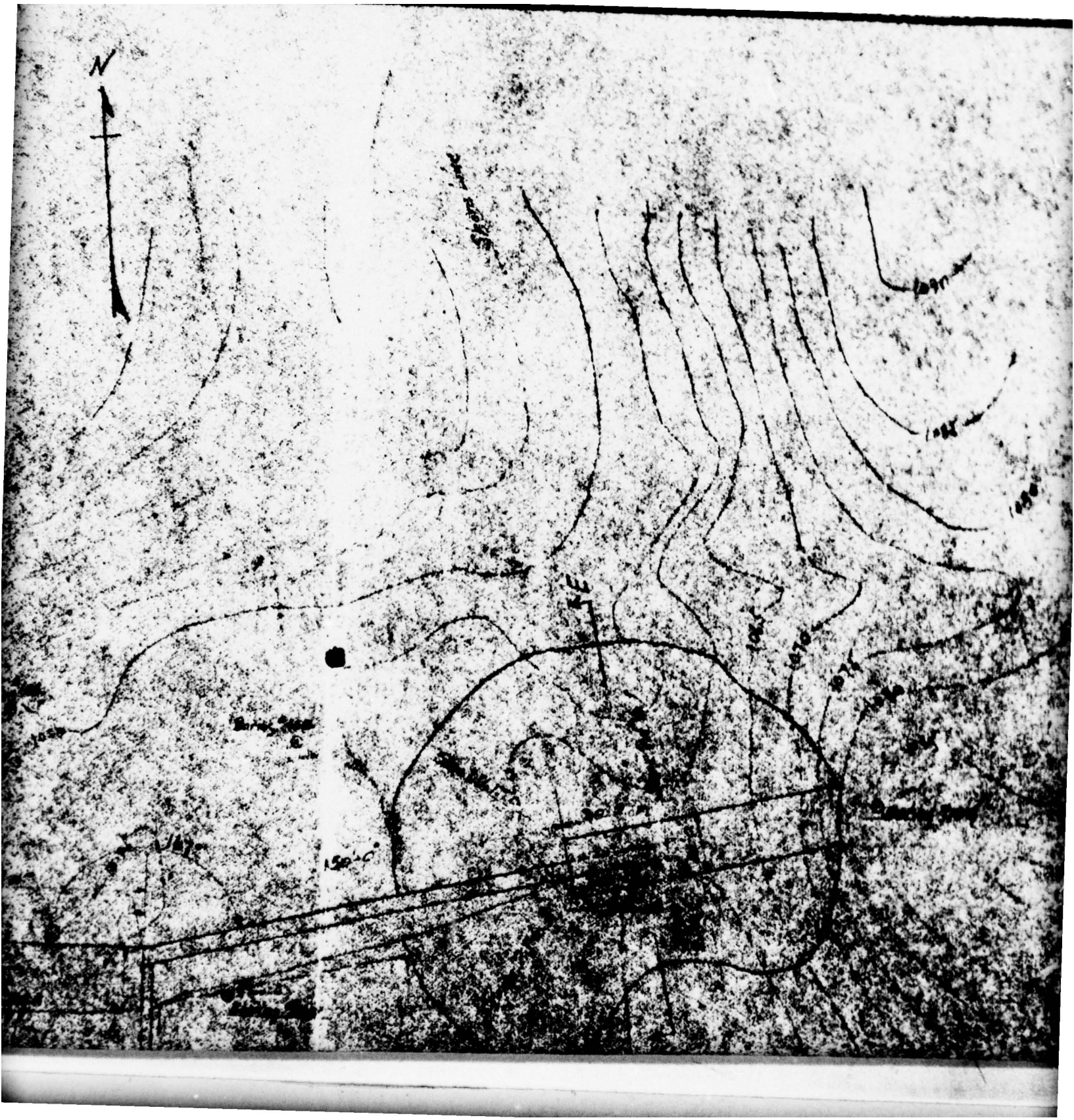
1900-52

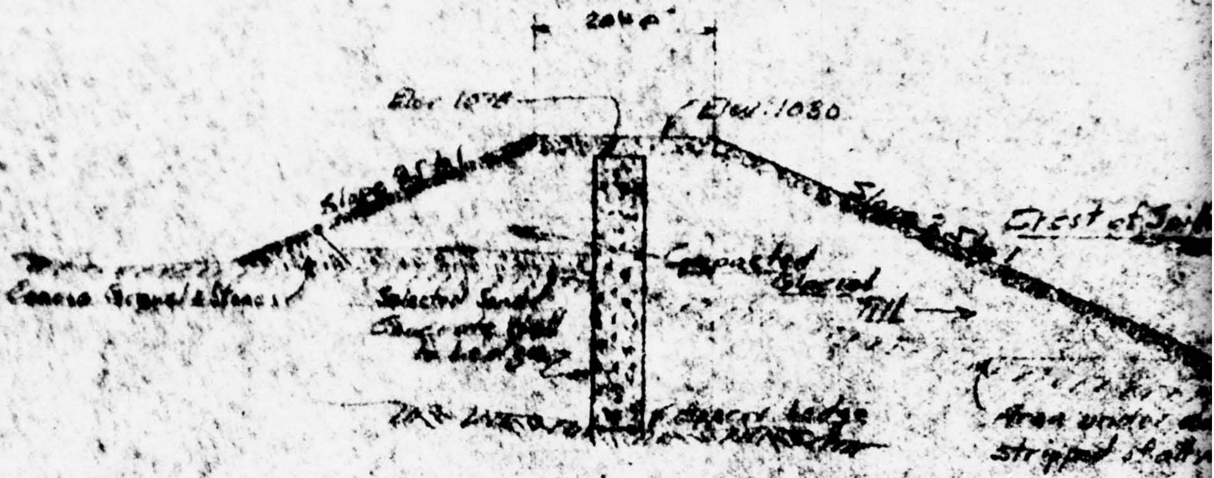
14



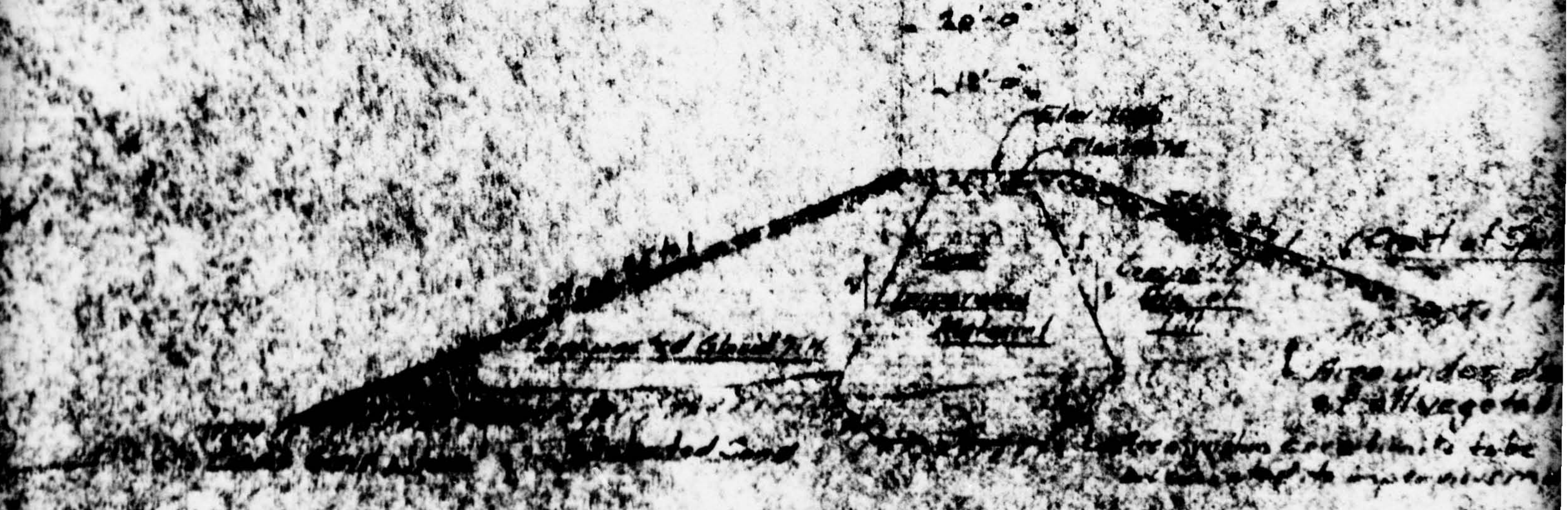


Shore Line
C
A
Coffer Dam
Boring #117
Boring #112
Boring #107
D
1090
1080
1070
1060
1030
Top Elev. 1080
Boring #106


N



SECTION E-E
Scale 1"=20-0



SECTION D-D
Scale 1"=20-0

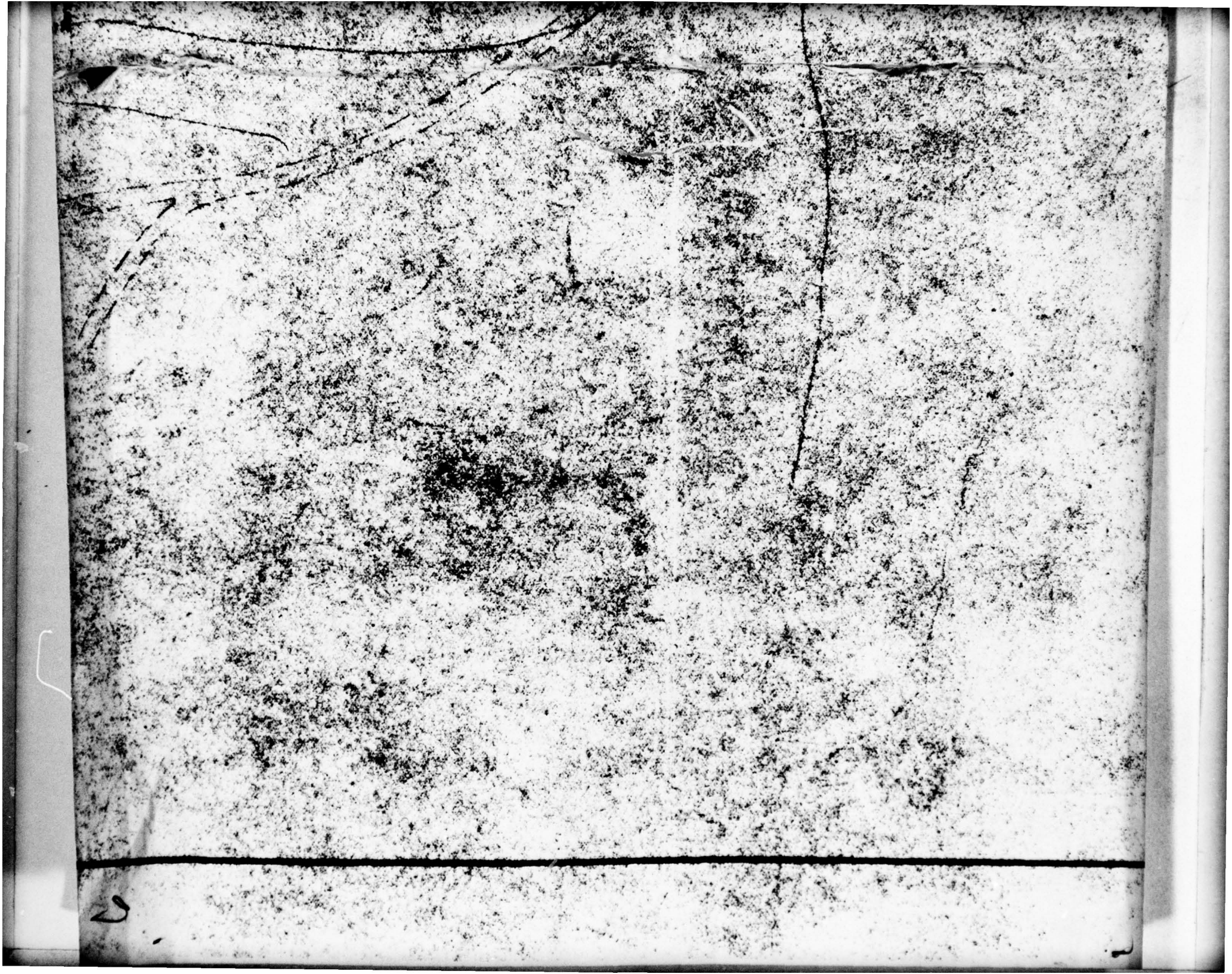
5

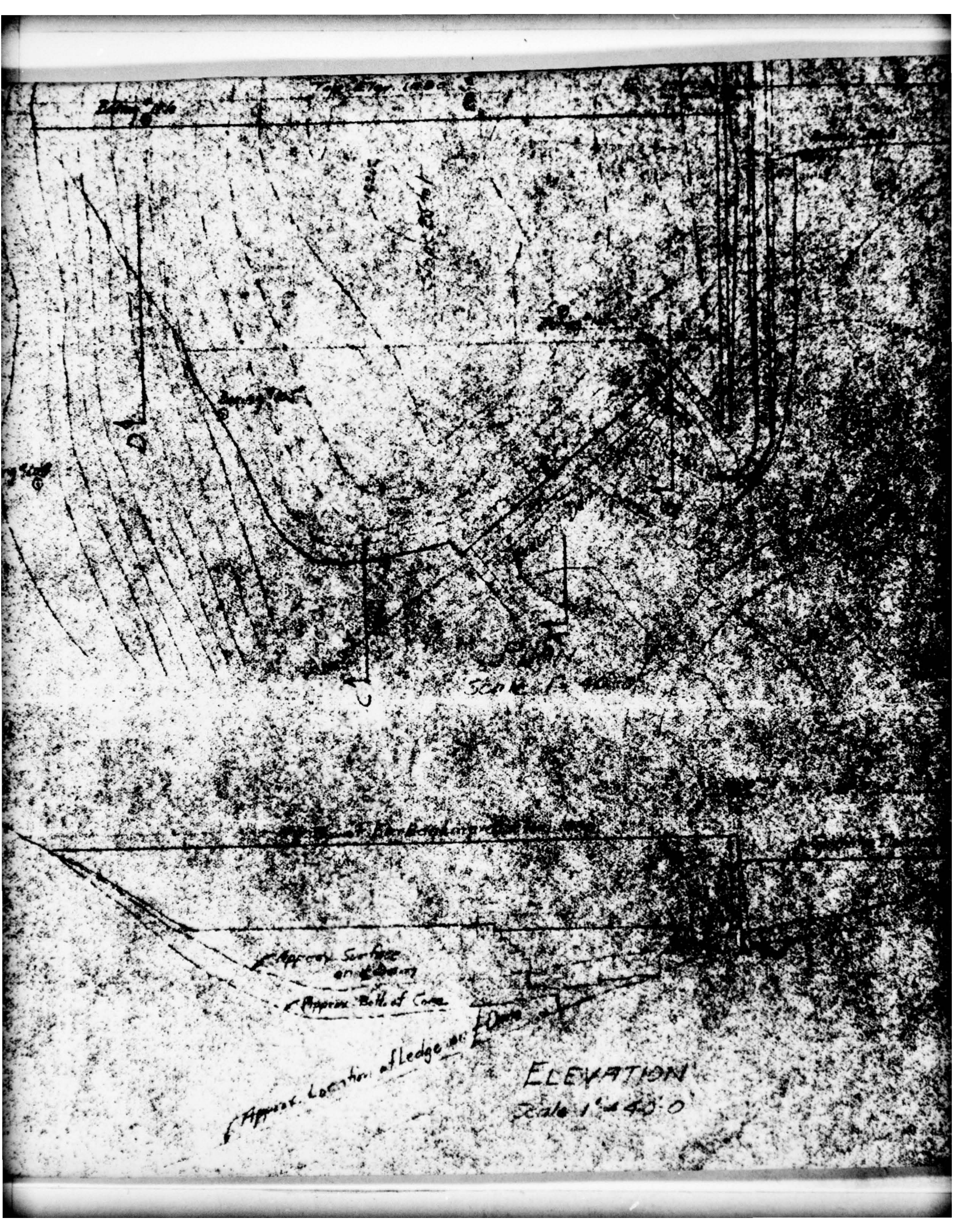
Elev 1070]

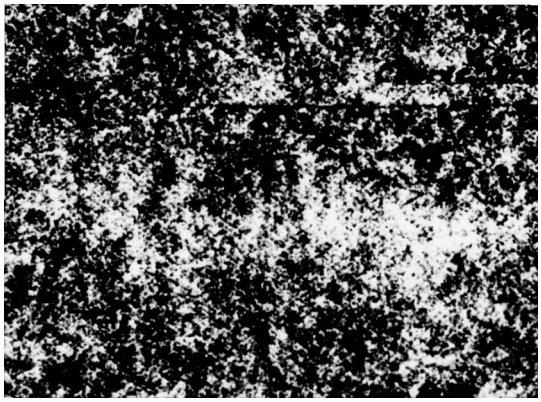
vegetable matter

Elev. 1070.

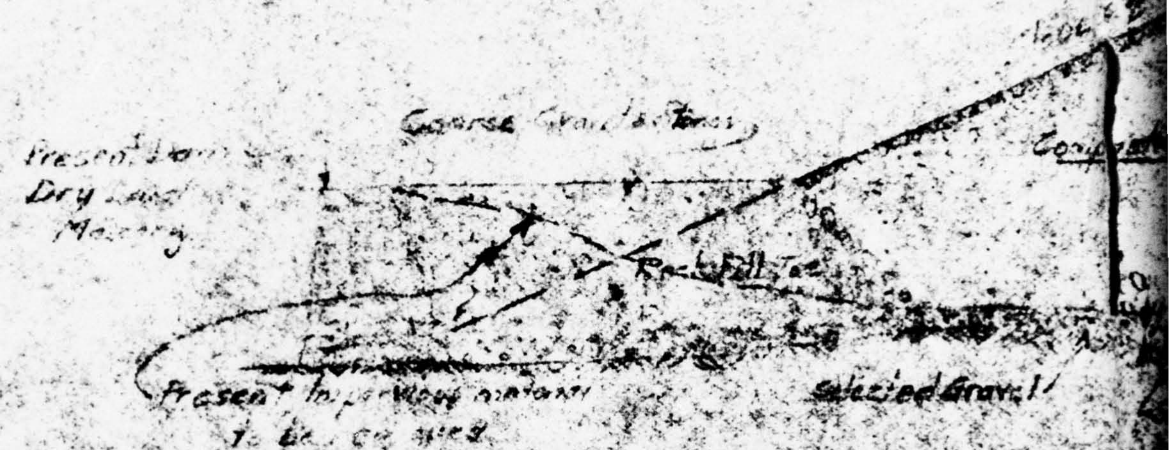
be stripped
matter.



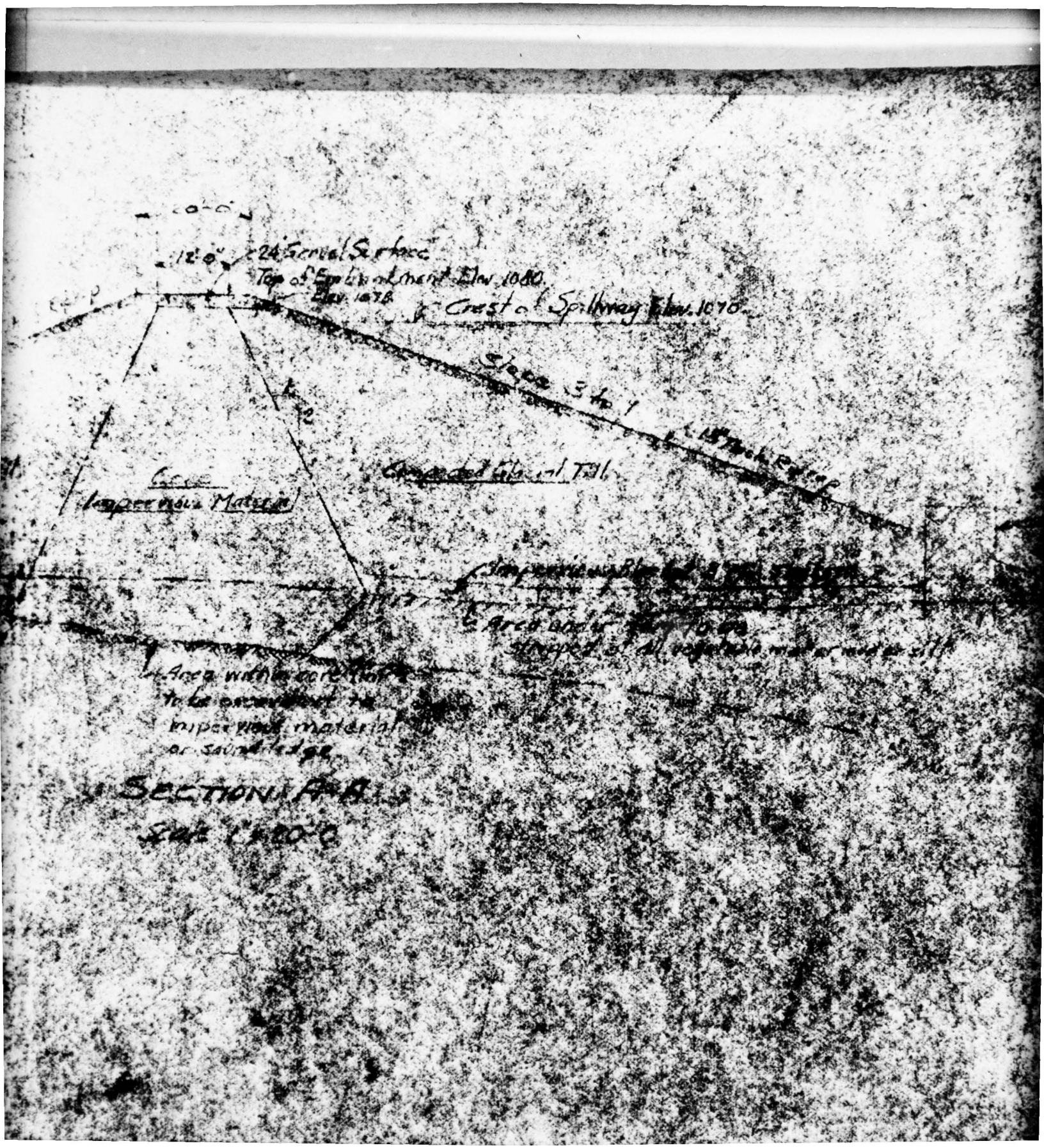

Approx. Surface of Ledge
Approx. Bottom of Cove
Approx. Location of Ledge at
ELEVATION
Scale 1"=40'-0"

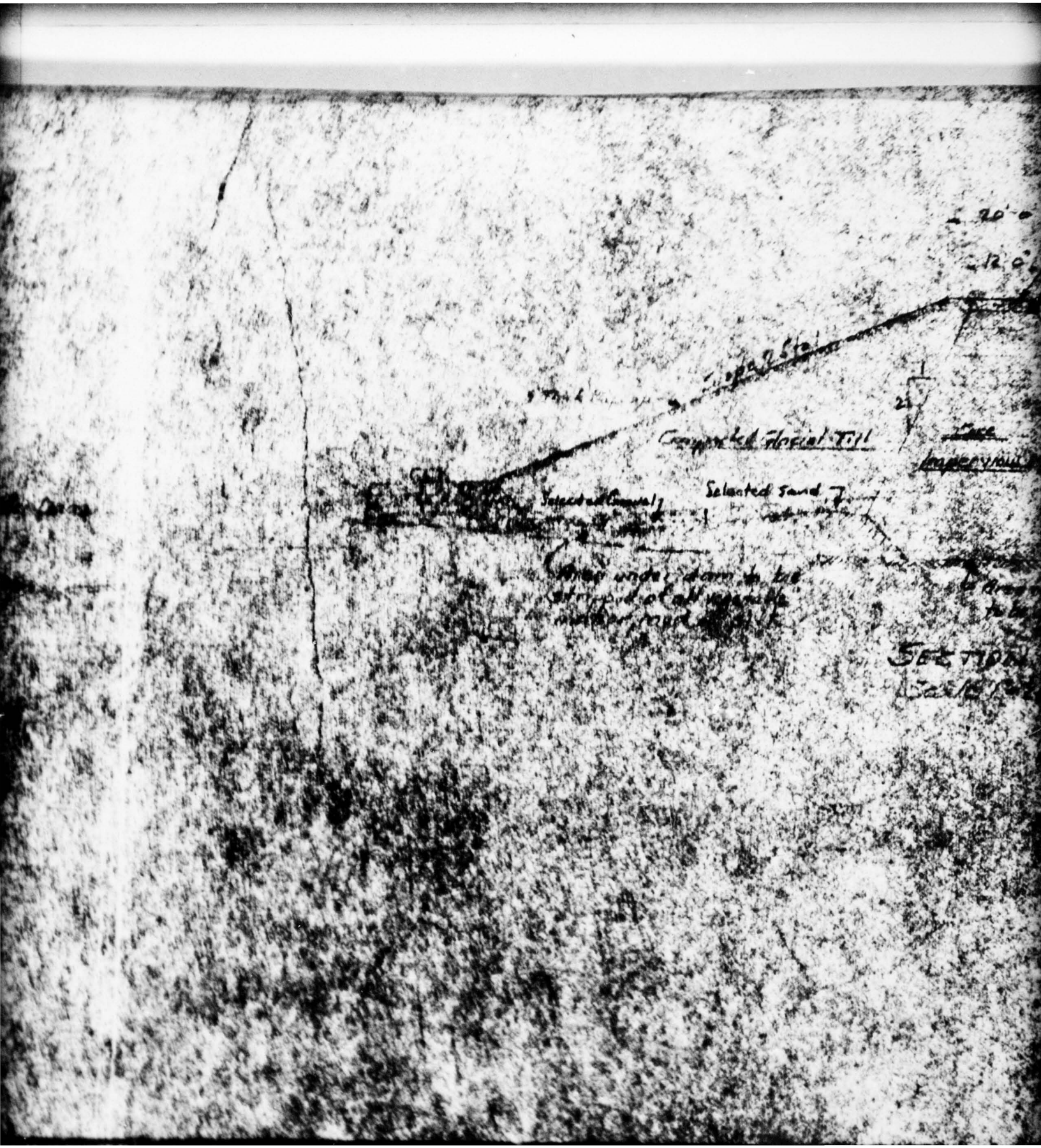


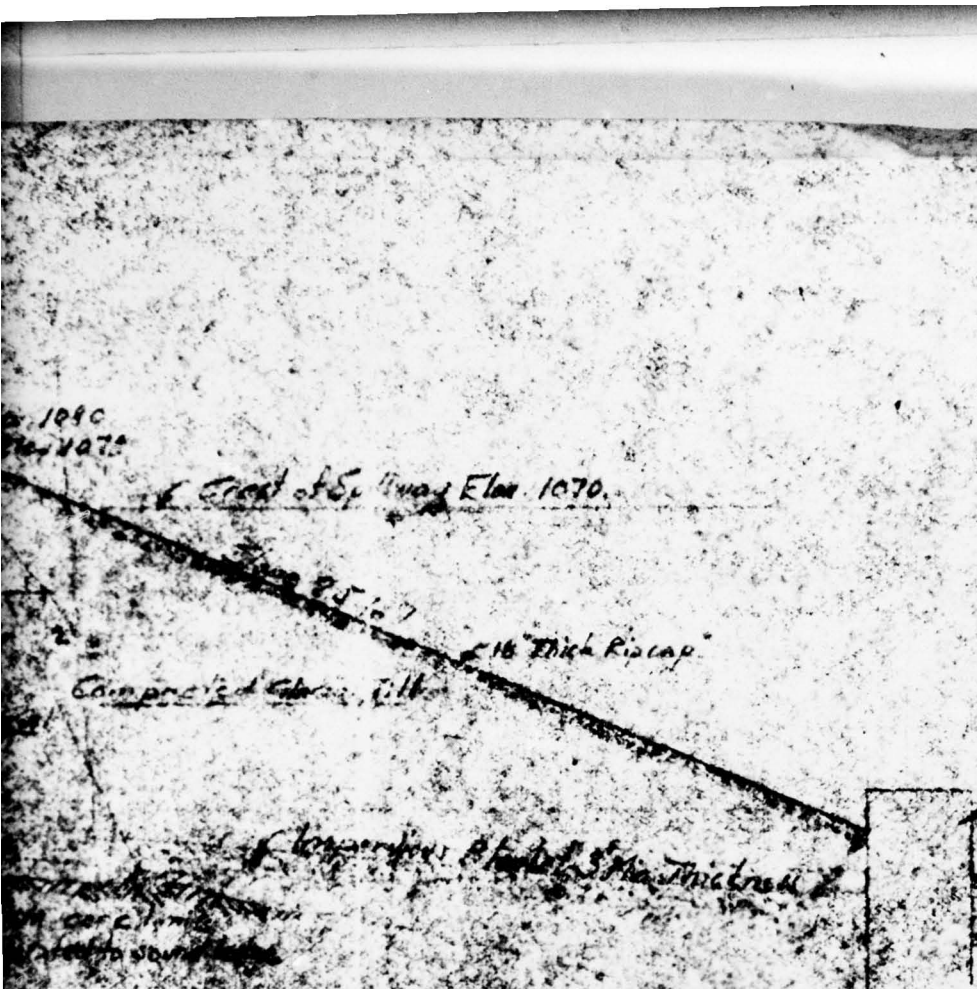

10



11


12'-0"
24' Gravel Surface
Top of Embankment Elev. 1080
Elev. 1078
Crest of Spillway Elev. 1070
Slope 3 to 1
Impervious Material
Area within core limits
to be excavated to
impervious material
or sound ledge
SECTION A-A
Scale 1"=20'-0"


Compacted Glacial Till
Selected Sand
SECTION



ROCKLAND LIGHT & PO
NEWYORK N.Y.
CLIFF LAKE DEVELO
PLAN & SECTIONS O

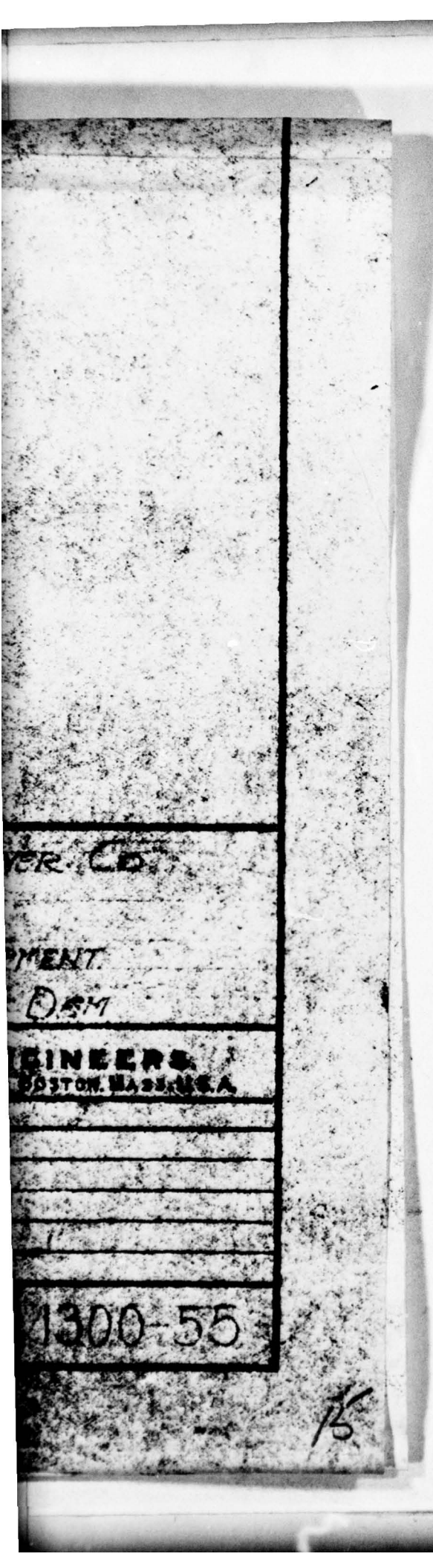
CHAS. T. MAIN, INC. E
361 DEVONSHIRE ST.

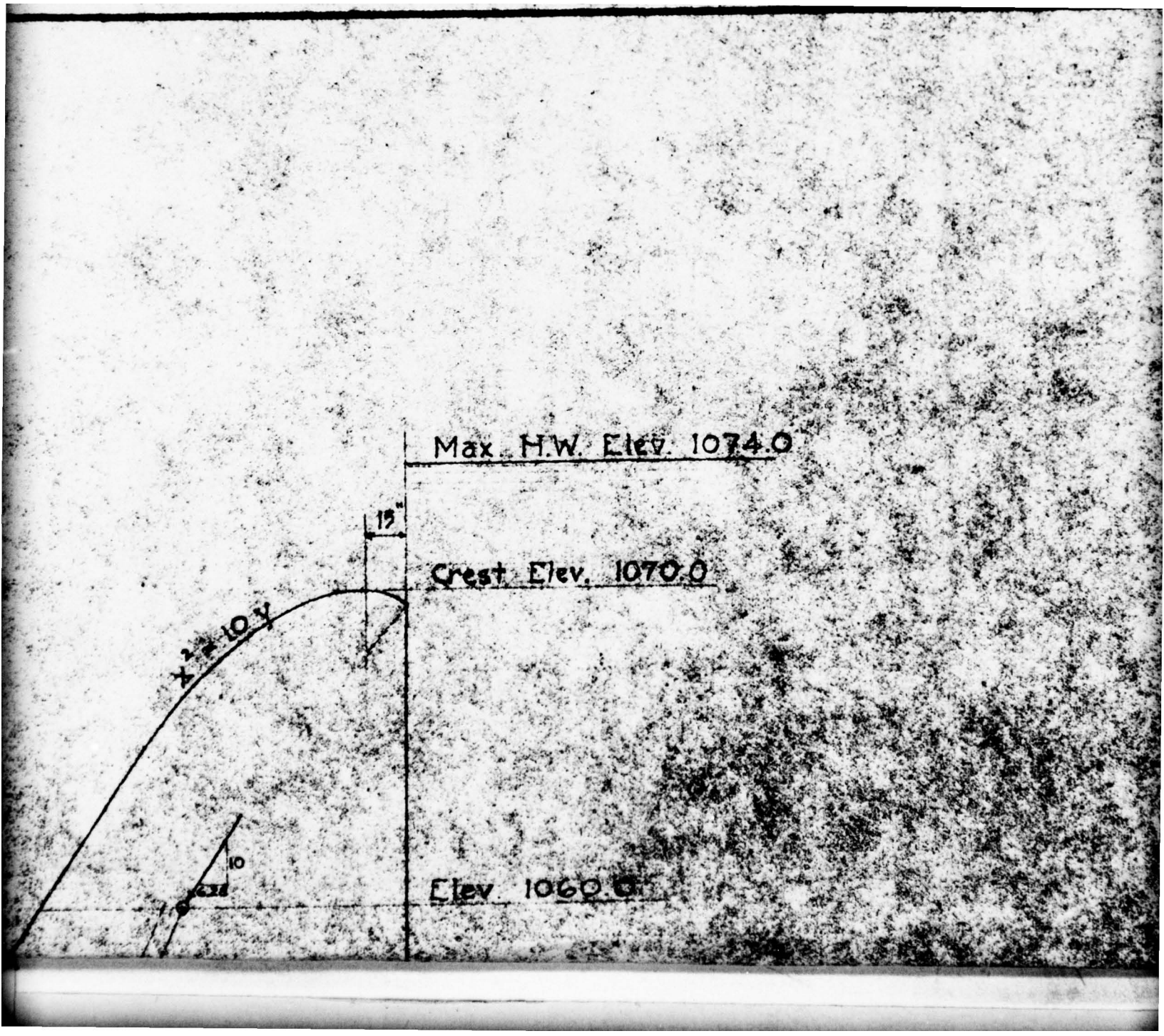
REVISIONS

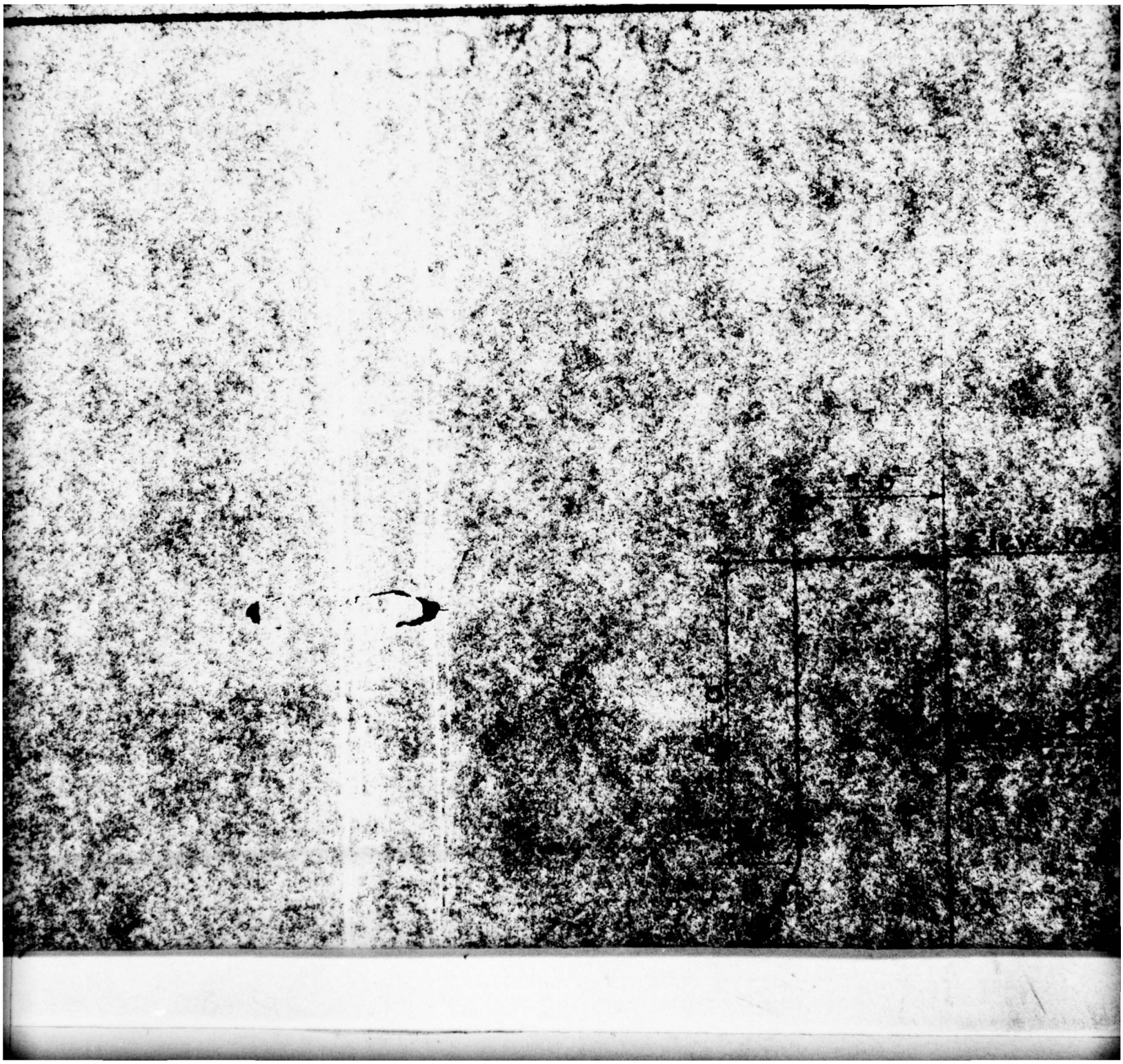
W.F.U

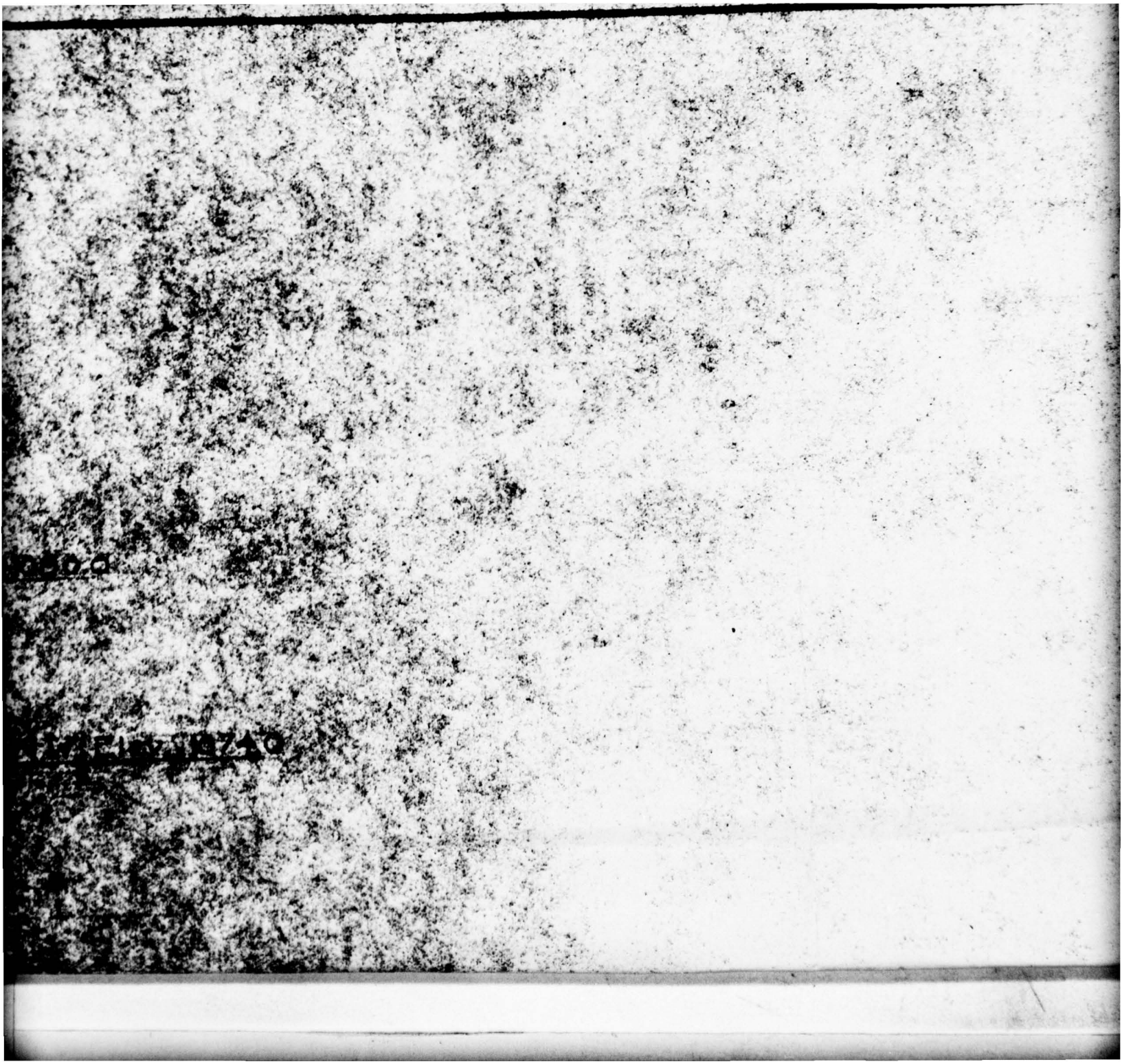
Scale: as noted

Date: June

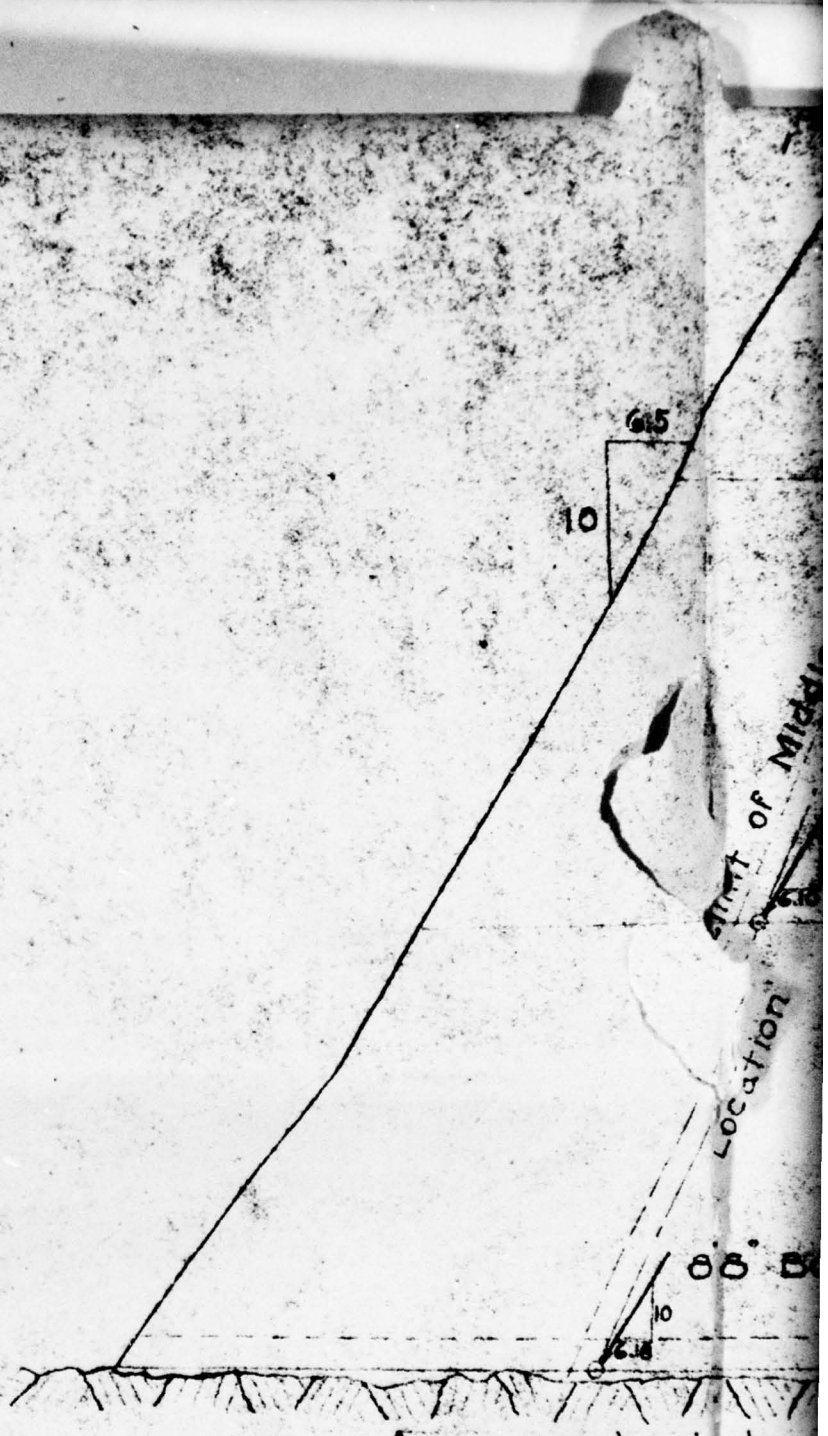

ER. CO.
MENT.
D.S.M
GINEERS.
1300-55


Max. H.W. Elev. 1074.0
15"
Crest Elev. 1070.0
$x^2 = 10y$
10
Elev. 1060.0

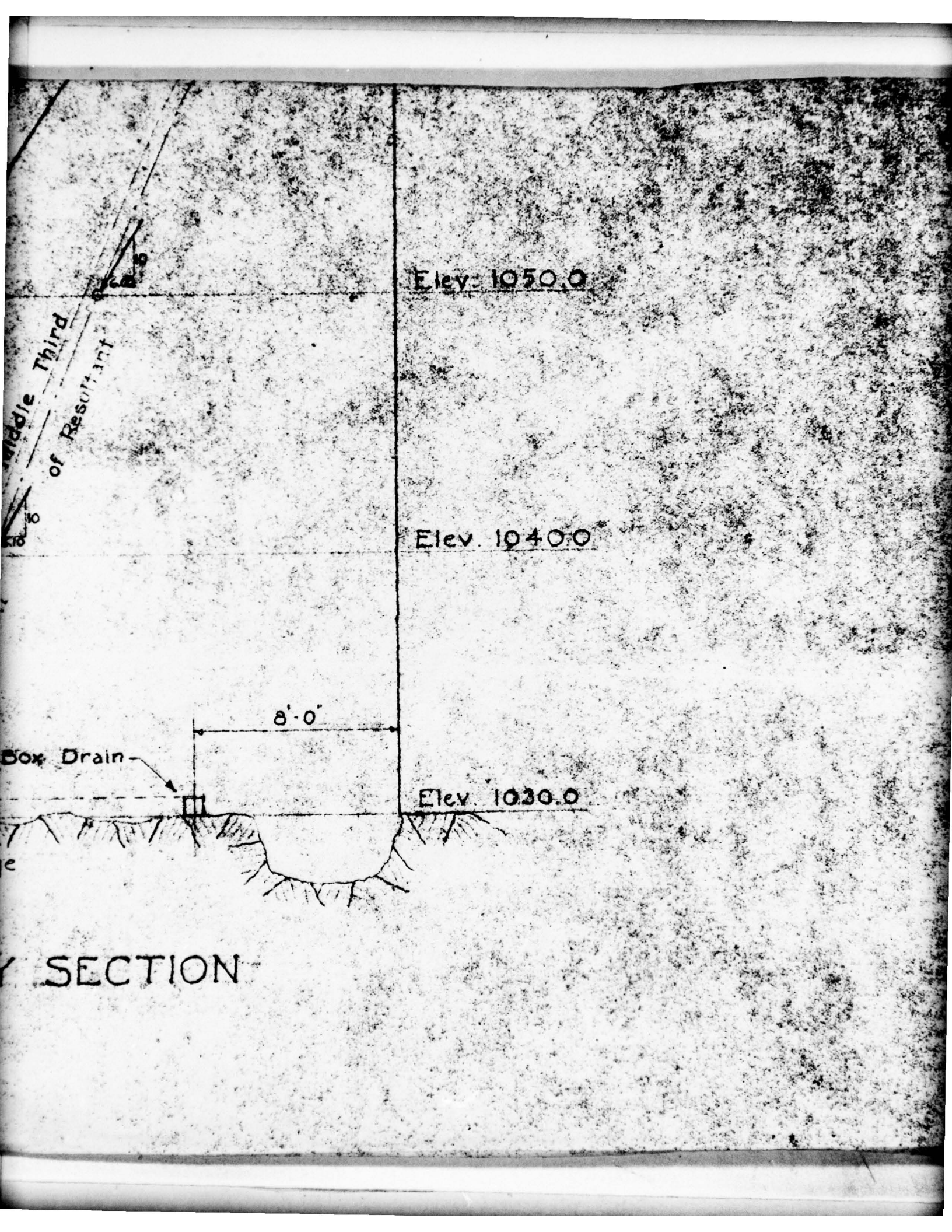


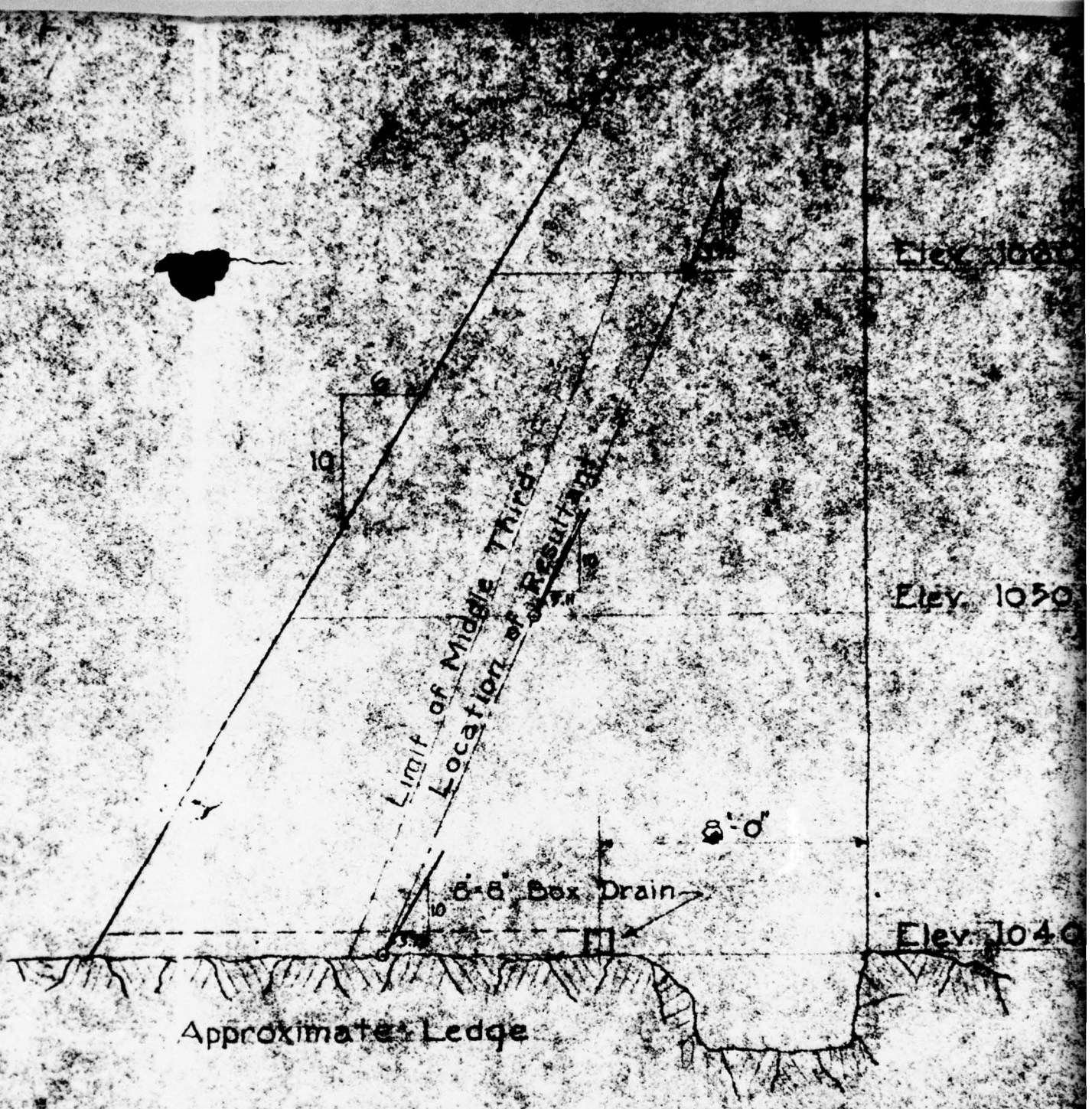


[redacted]



SPILLWAY

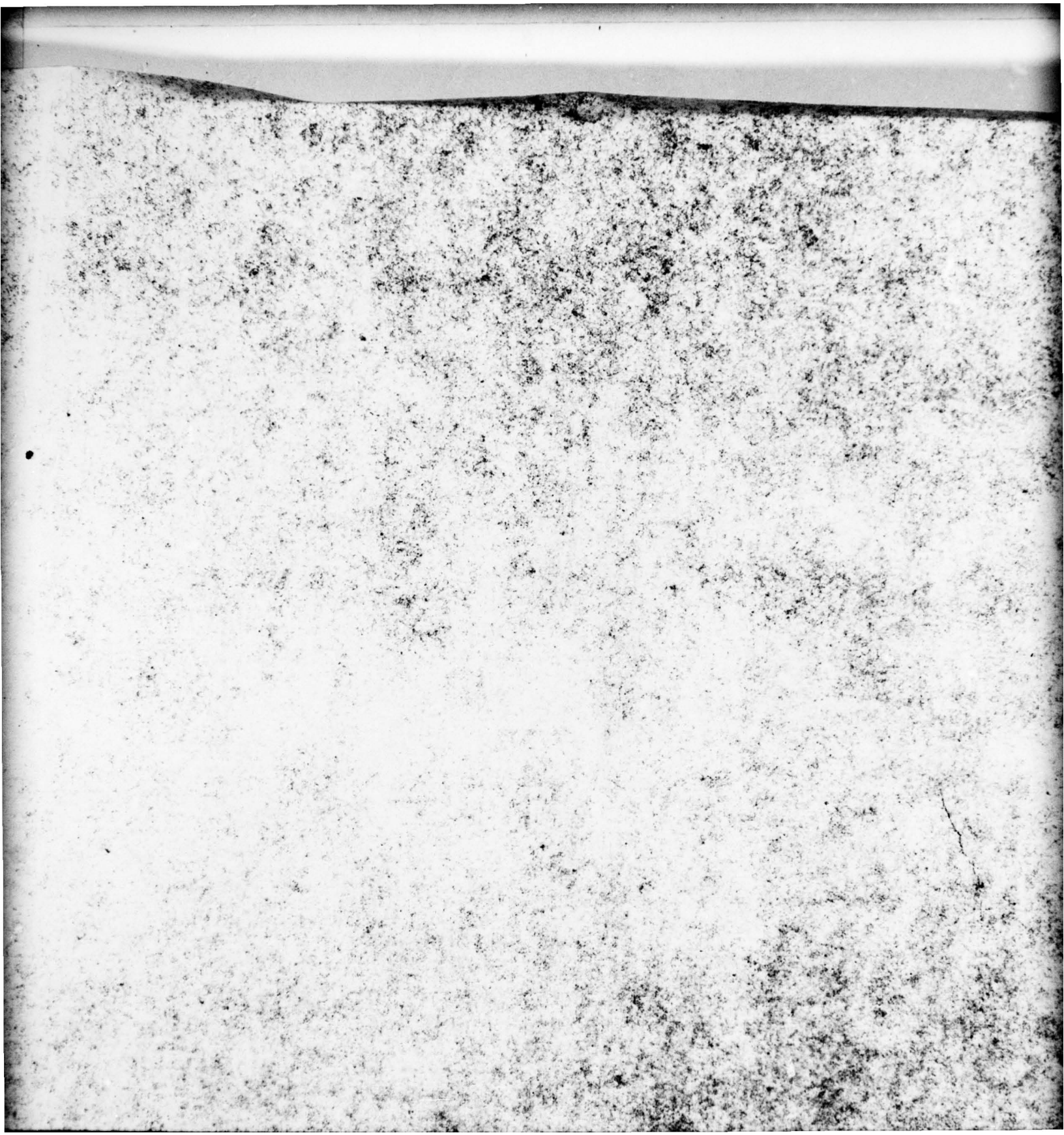

Elev. 1050.0
Middle Third
of Resultant
10
10
Elev. 10400
8'-0"
Box Drain
Elev. 1030.0
SECTION



ABUTMENT WALL SECTION

9

15



Conditions of Loading :-

Head water at elevation 10
tail water.
Loads figured for one linear

Assumptions for Analysis :-

Weight of concrete 145 lbs. pe
Weight of water 62.5 lbs. per
Uplift on base is 2/3 full stat
upstream face, decreasing
at 8" drain. (Elev. 1050 and
Uplift on horizontal constr
joint is 1/2 full static head
face, decreasing to zero a
Elev. 1060 only)

ROCKLAND LIGHT AND
NYACK, N.Y.
CLIFF LAKE DEVEL
DAM STRESS S

CHAS. T. MAIN, INC., EN
201 DEVONSHIRE ST.

REVISIONS	

IN CHARGE OF W.E.U.	SCALE 1/4" = 1'-0"
DRAWN FPP / TRACED / CHECKED	DATE July 6 1938

.0 ; no

oot.

cu. ft,
. ft.
head at
to zero
elow)
ction
t upstream
toe. (For

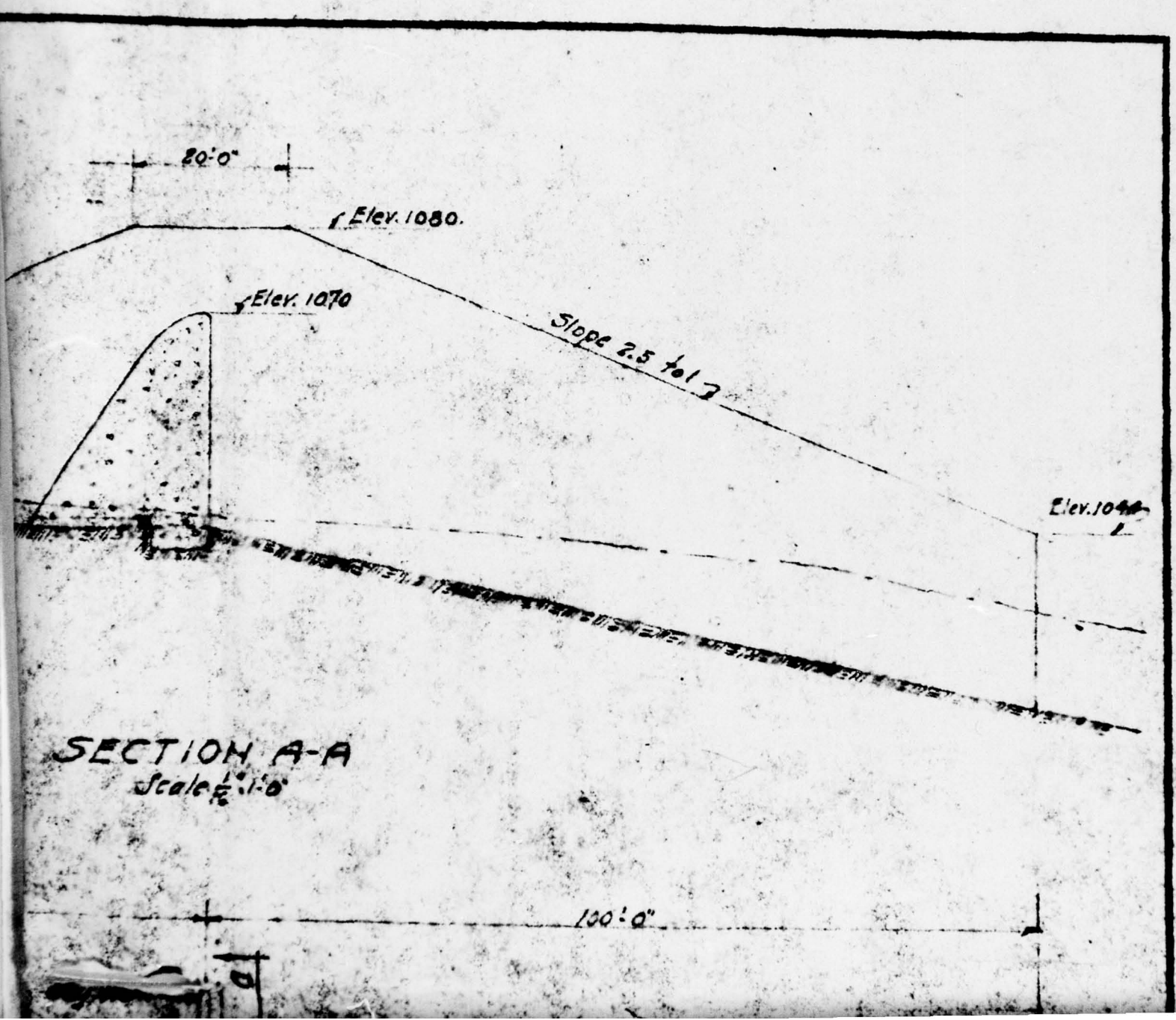
POWER CO.

MENT
EET

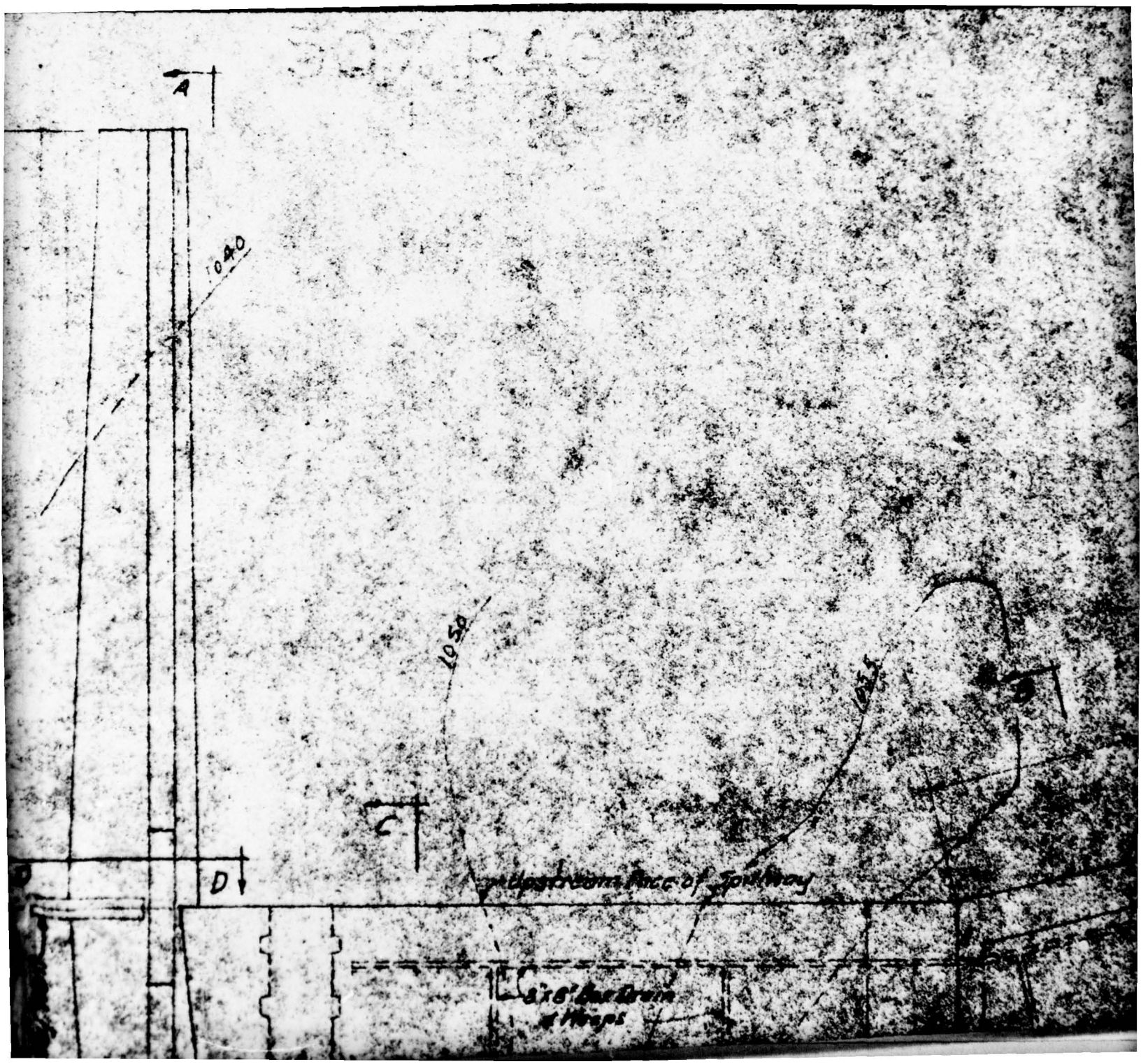
NEERS.
TON, MASS. U.S.A.

300-56

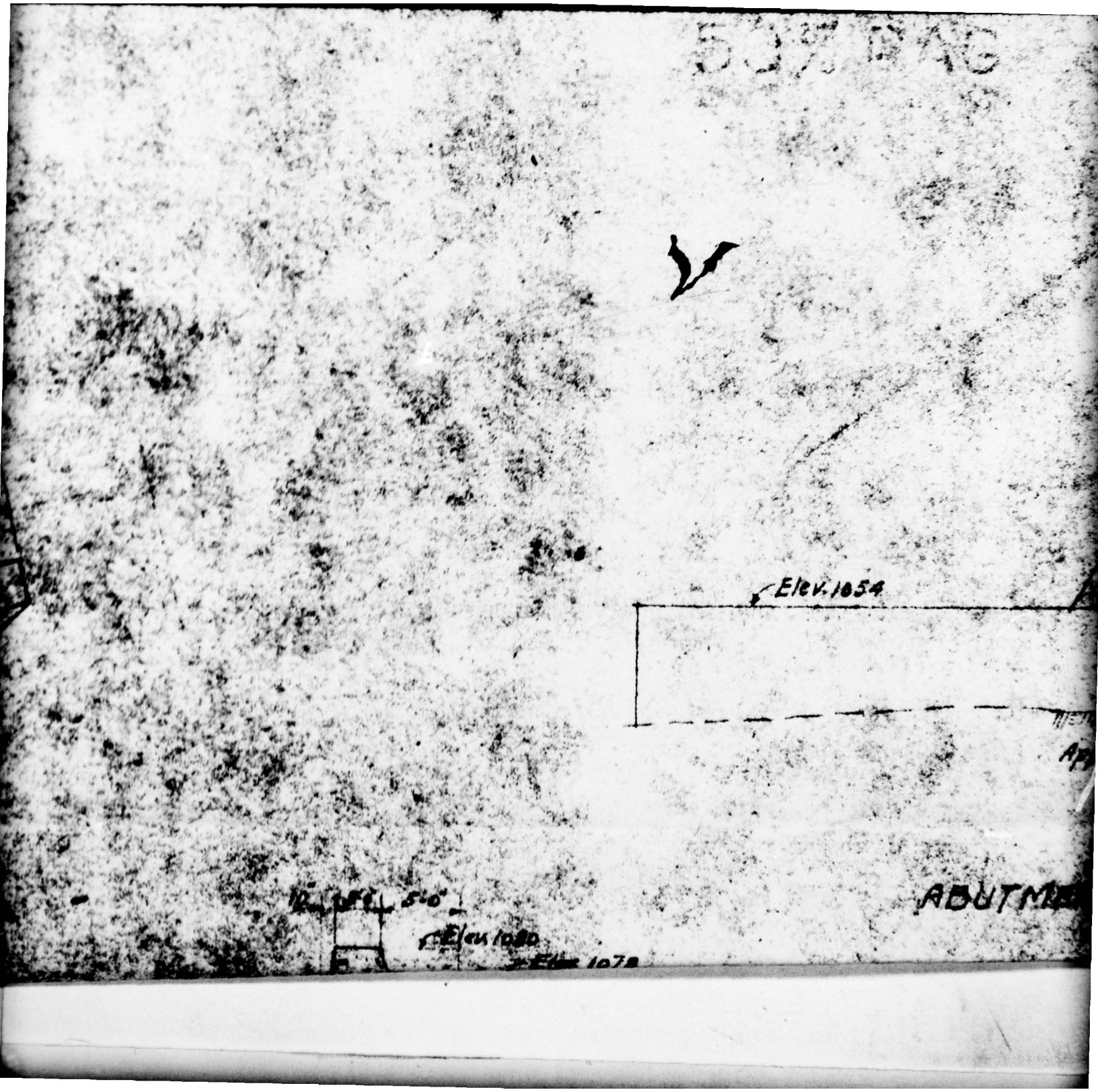
15

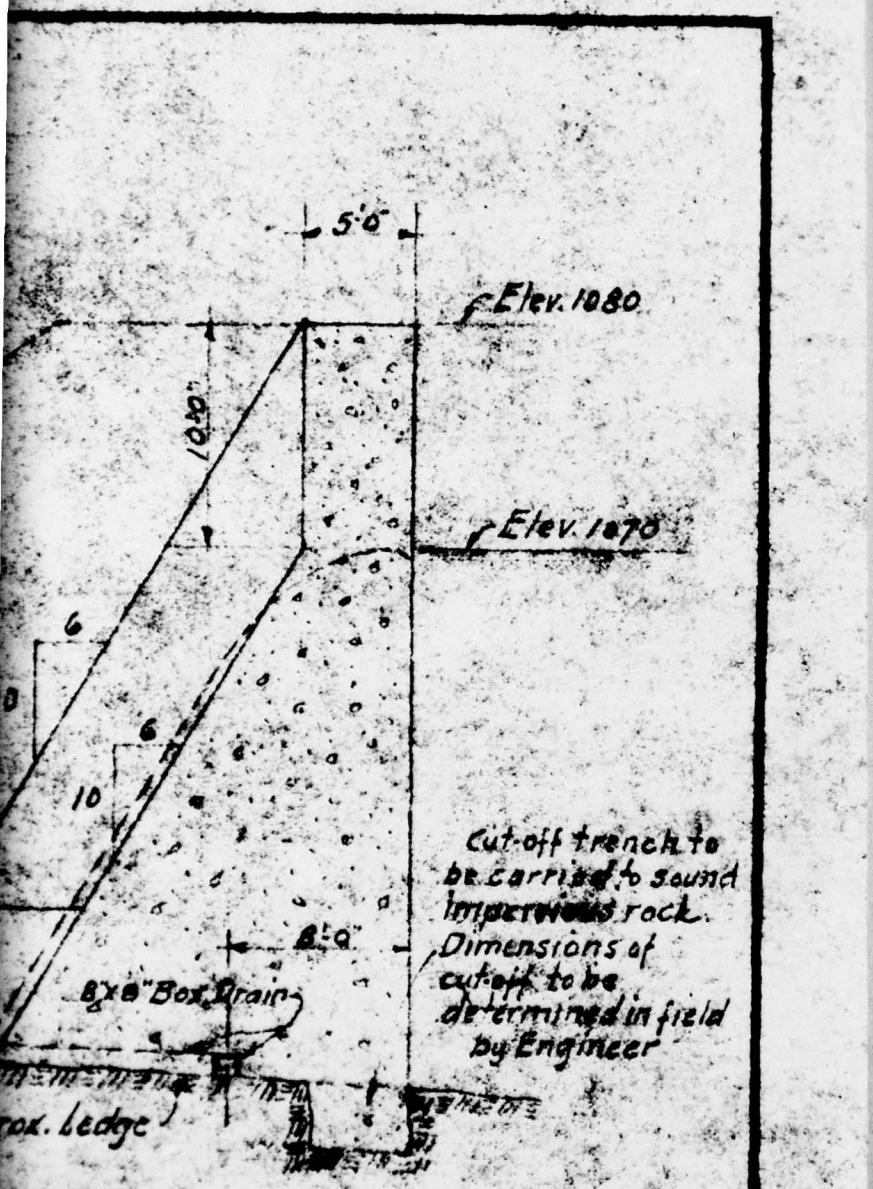


SECTION A-A
Scale 1/2" : 1'-0"

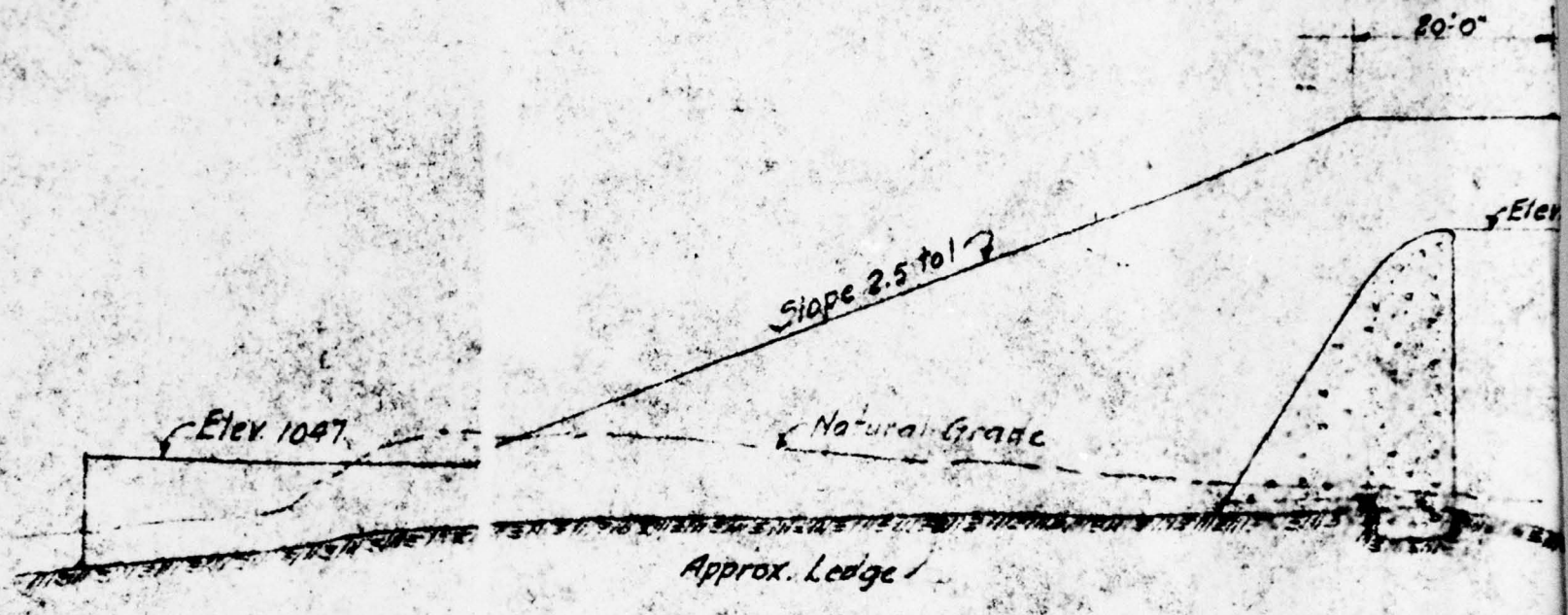

A
1040
1050
C
D
Upstream Face of Spillway
6'x6' Box Drain
at Weirs


150'-0"


Elev. 1054
ABUTME
5'0"
Elev 1080
Elev 1078



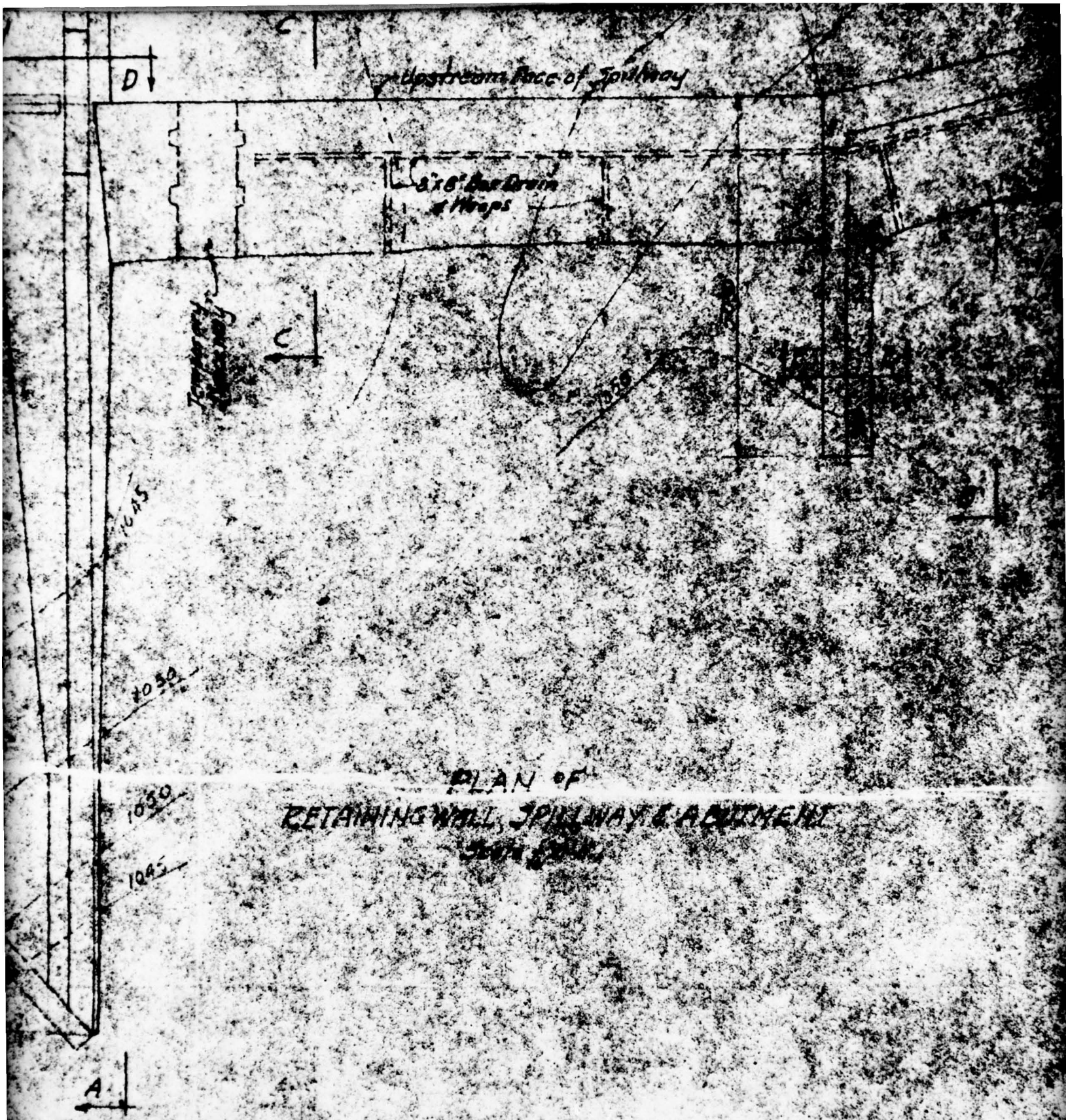
T SECTION, B-B
Scale 1/8"-1'-0"



SECTION A

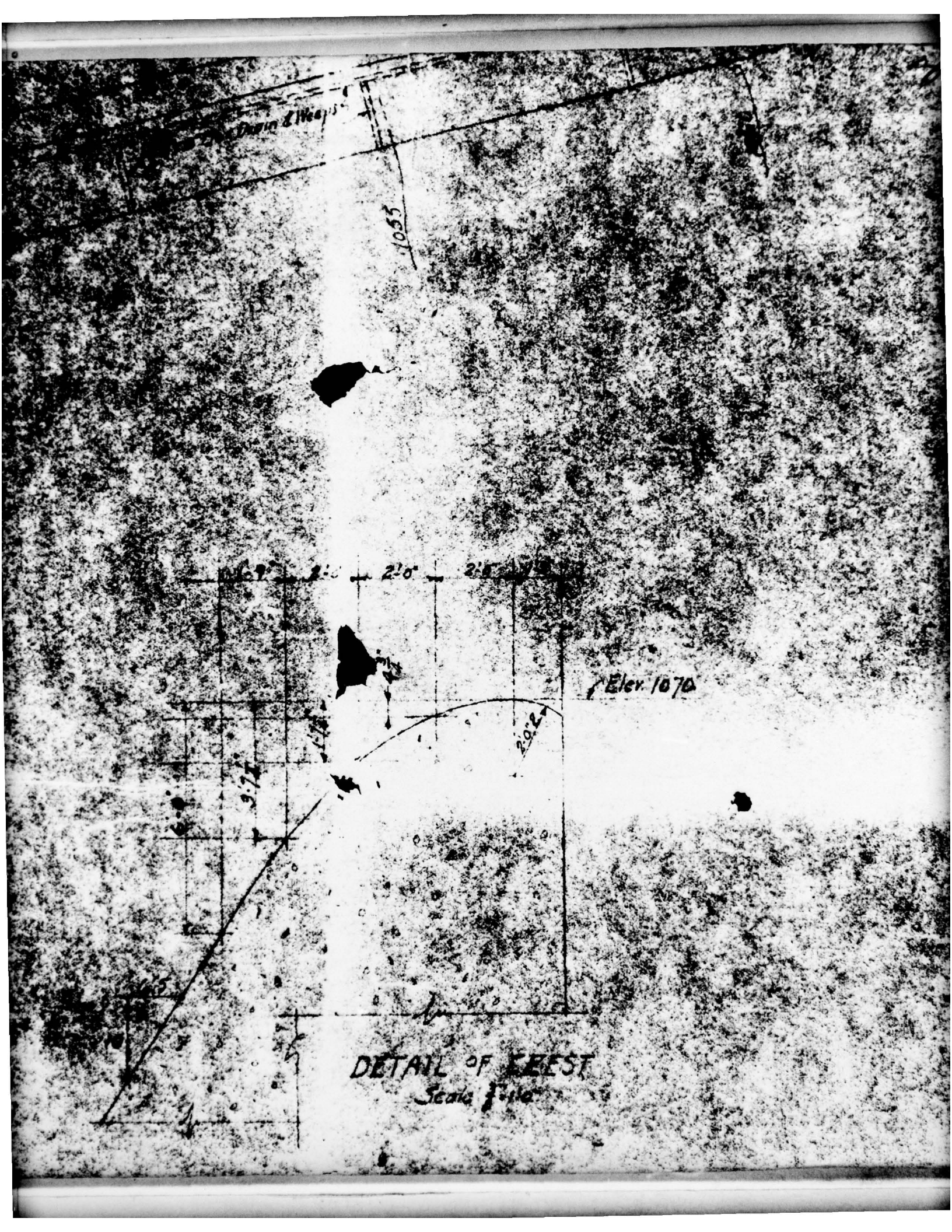
Scale 1/8" : 1'-0

128'-0"



PLAN OF

RETAINING WALL, SPILLWAY & ABUTMENT

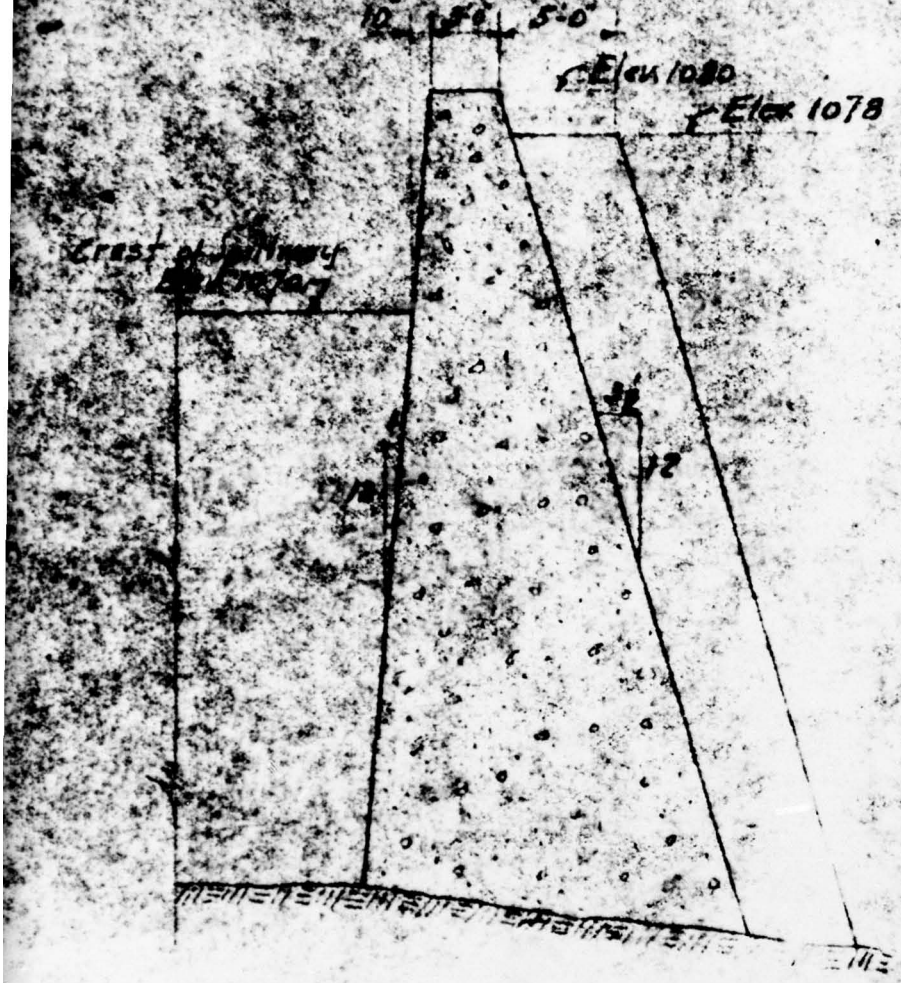

Drain & Weep
1055
2'-0"
2'-0"
Elev. 1070
2'-0"
DETAIL OF EAST
Scale 1"=1'-0"

Approx.

9

ABUTMENT

S



Toe of
Outline of

Approx. L

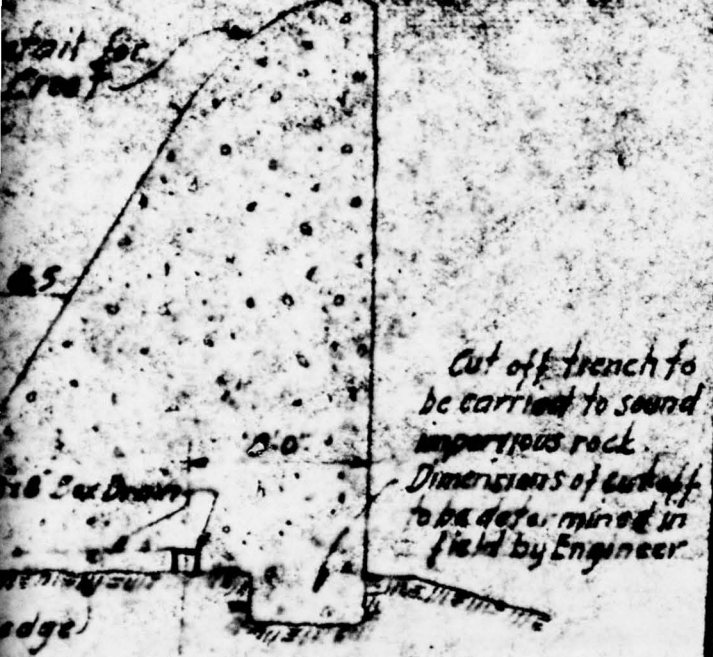
RETAINING WALL SECTION

Scale - 1/8" - 1'-0"

SPILL

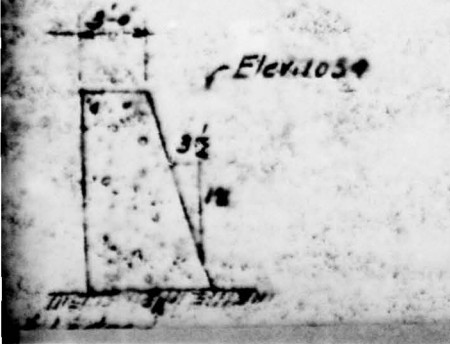
SECTION B-B

Scale 1/8" = 1'-0"

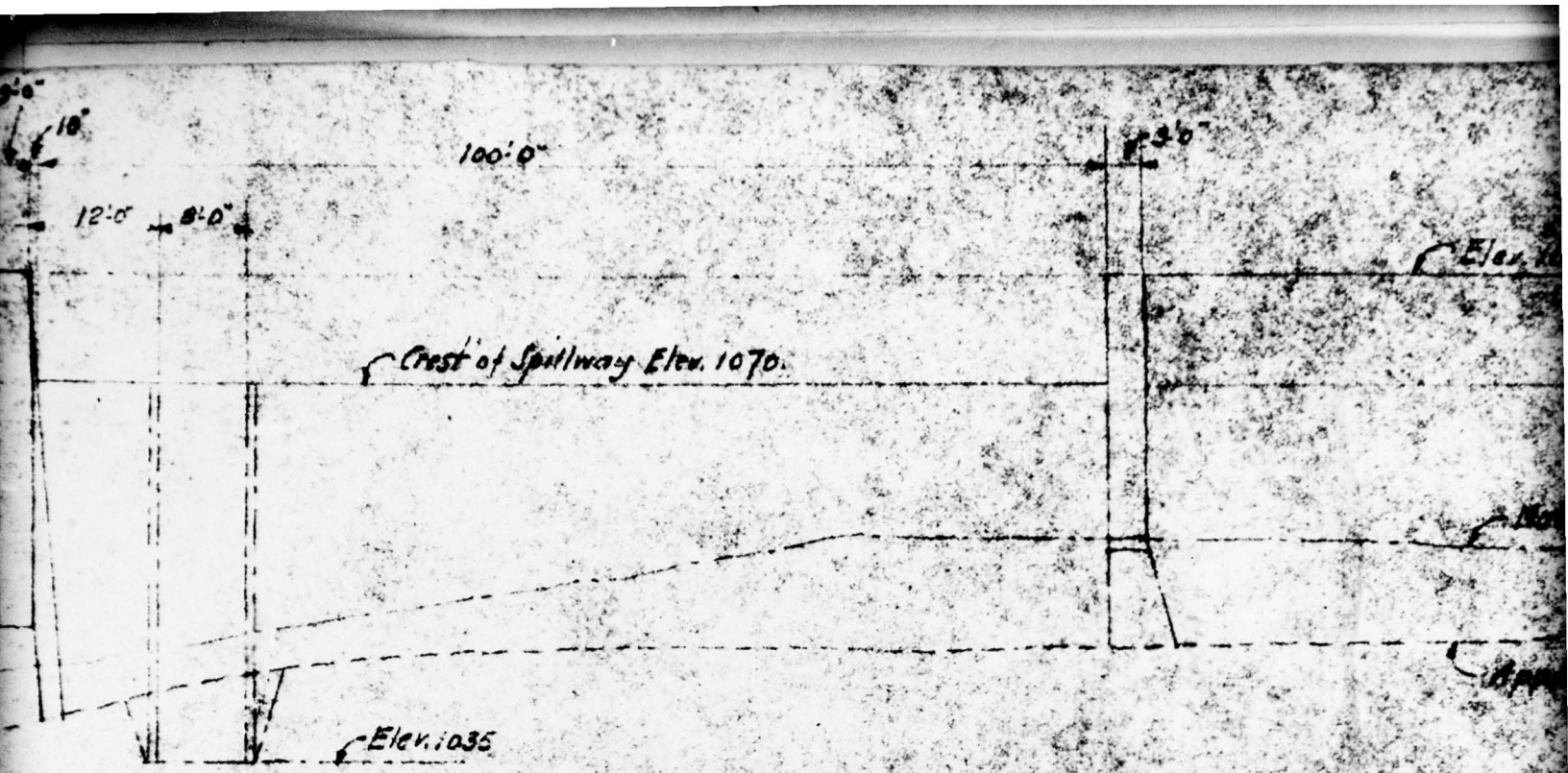


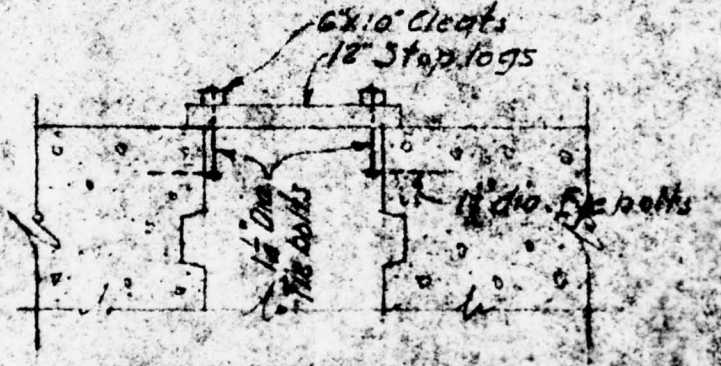
WAY SECTION C-C

Scale - 1/8" = 1'-0"

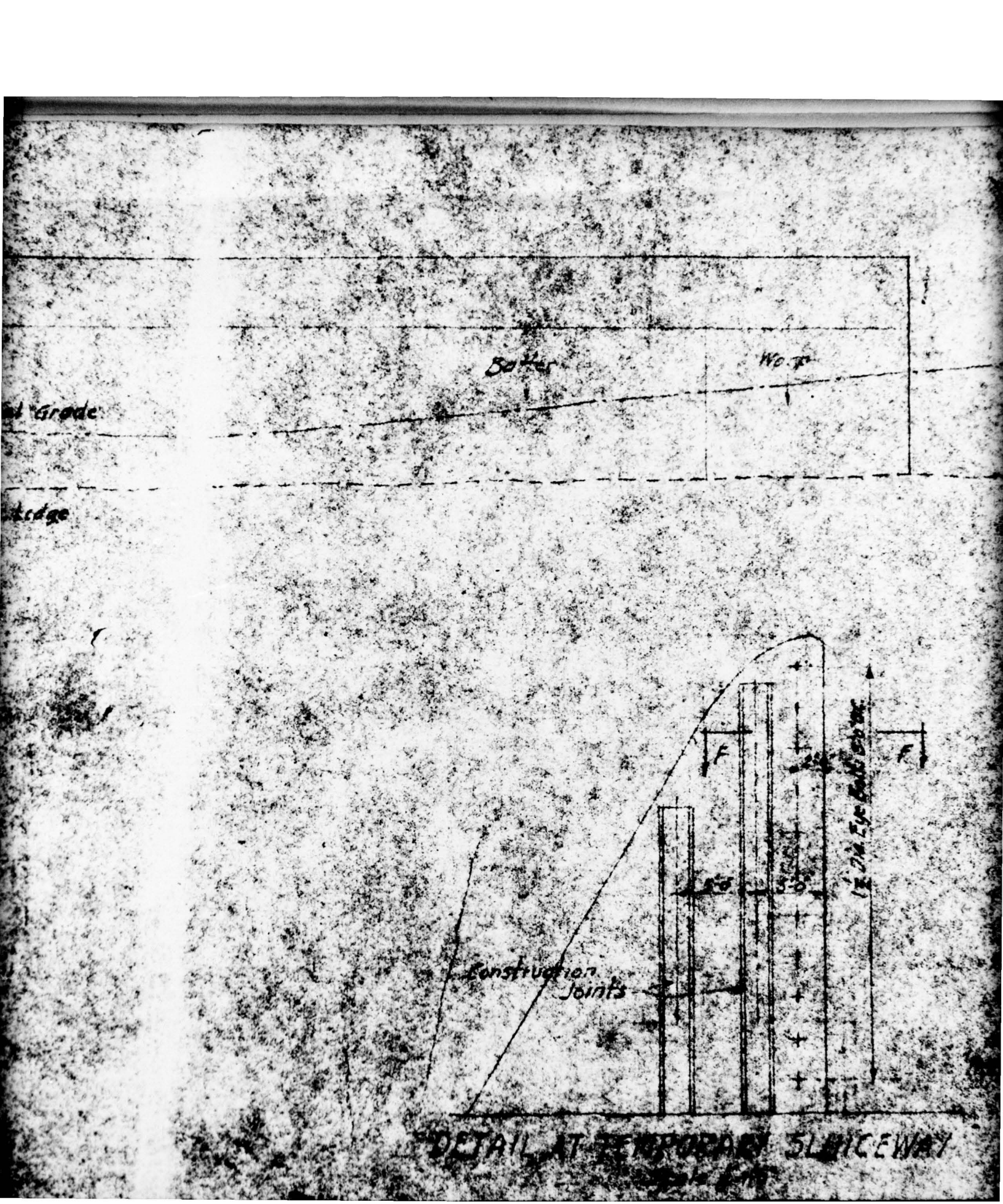



Abutment Wall
of Present Dam


18"
100'-0"
12'-0"
8'-0"
Crest of Spillway Elev. 1070.
Elev. 1035


6"x10" Cleats
12" Stop logs

SECTION F-F



DETAIL AT TEMPORARY SLUICEWAY

WING WA
3rd

ROCKLAND LIGH
NYACK
CLIFF LAKE
SPILLWAY &

CHAS. T. MAIN
201 Devonshire St

REV

IN CHARGE W.A.U.
SCALE
DRAWN | TRACED | CHECKED
DATE

SECTION E-E

POWER CO.

OPMENT

UTMENT

C. ENGINEERS.
BOSTON, MASS. U.S.A.

ONS

1300-57

16